

The AMSAT Journal

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Phase 3D Spaceframe Arrives at Orlando Integration Facility

Upon completion of the fabrication process at Weber State University the Phase 3D spaceframe was trucked to the Orlando, Florida Spacecraft Integration Facility in mid-July. Dick Jansson, AMSAT-NA Engineering Vice President, reports that a preliminary inspection reveals that the 100

pound (45 kg) aluminum structure appears to have arrived in good shape. Work will accelerate on the project as the international team looks toward a 1996 launch date. See the related article in *Notes from the Field* on page 15.



Frank Lavra watches as Stan Wood and Dick Jansson uncreate the Phase 3D Spaceframe.

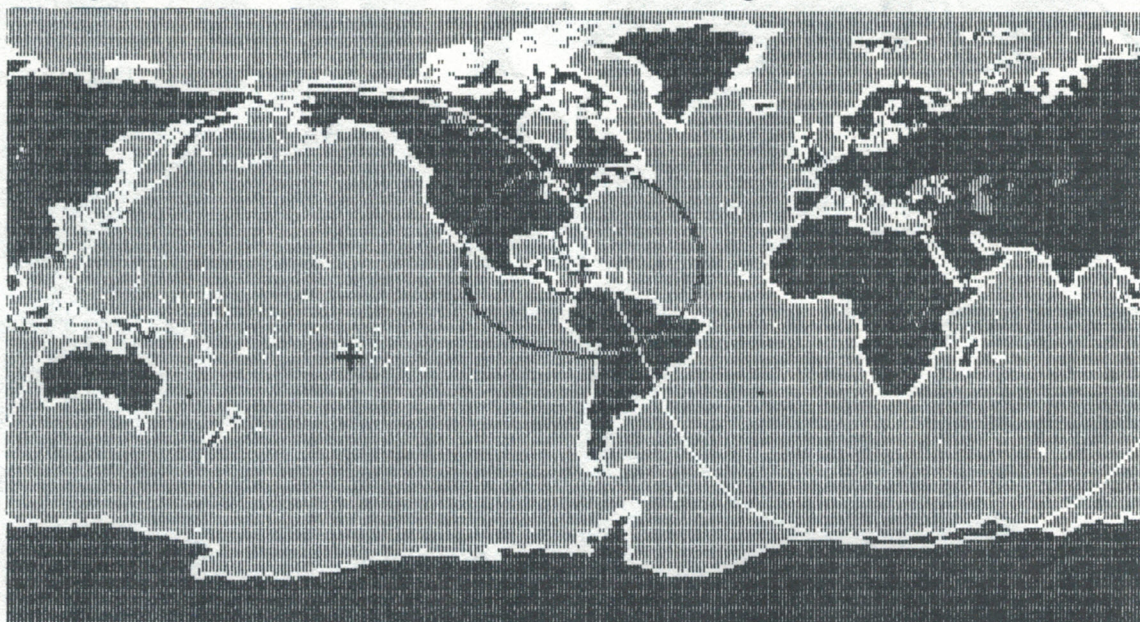
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Apogee View

Making Your Voice Heard

by Bill Tynan, W3XO

By now, you should have received a ballot for electing members to the AMSAT Board of Directors. This ballot is YOUR chance to make your voice heard as to how AMSAT is to be run during the next year, and in the years to come. It is very important that each AMSAT member exercise his or her opportunity to vote. Before marking your ballots, however, please carefully consider the qualifications of the various candidates.

The task of deciding how to cast your vote this year is a particular challenge because of the relatively large number of candidates from which to choose, and the unquestioned high qualifications of all of them. In order to aid you in making your choices, the ballot is accompanied by an enclosure presenting biographies for each of the candidates. Please read them carefully.

An important consideration is the size and nature of the organization. One of the challenges AMSAT faces is the growth that has taken place over the past few years. The Radio Amateur Satellite Corporation has gone from a small group of mostly techies, to an organization of over eight thousand members. While many of the original techies are still around and many new ones have come aboard, most of our members do not consider themselves in that category. Most are primarily interested in operating via the various satellites. In other words, they use what the techies build for them. We have also come a long way financially. When we began in 1969, our membership and treasury was about on a par with many average local radio clubs. Even as recently as 1987, the first year for which we had an independent audit of our finances, AMSAT-NA's Fund Balance was \$141,764. For not-for-profit organizations, the Fund Balance is equivalent to Net Worth for profit-making organizations. Income for 1987 totaled \$167,605 while expenses ran \$190,669, leaving a deficit of \$23,064. Our December 1993 financial statement shows income of \$416,030 and expenses of \$324,488, leaving an excess of income over expenses for the year of \$98,859. (That "excess," and a lot more, must be spent on Phase 3D later in the program when the heavy bills start coming in.) The statement also lists total assets, at the end of the year, as \$427,879 and liabilities of just \$18,785 for a fund balance of \$409,094. The bottom line is that our Fund Balance has almost quadrupled in this

six year period. The great preponderance of our assets are in liquid bank deposits or marketable securities.

My point here is not to brag about how well we have done over the past few years, but rather to convey the seriousness of the job of guiding this now substantial enterprise. Obviously, a large proportion of this increase in assets was a direct result of the campaign mounted to fund Phase 3D, and we actually will need much more money than we have if we are to meet the Phase 3D funding goals to which we are committed. That fundraising, too, is the responsibility of the Board of Directors. But, the point is that AMSAT-NA is no longer a local radio club or even a small to moderately sized national organization. Our membership is now over than eight thousand. That alone should produce annual income of almost One Quarter Million Dollars.

Of course, the increase in membership has also resulted in higher expenses for membership services, publications and so forth. There is a flip side to everything. Despite the fact the we have grown to an over eight thousand member organization with assets approaching a half million dollars, AMSAT is still almost entirely a volunteer enterprise. We still have but ONE full-time employee, Martha Saragovitz, our Headquarters Office Manager. She is also the Corporate Secretary, but that is a volunteer position. If we were to depart, to a significant extent, from this policy of depending on volunteers for most of our labor, our assets would decline rapidly and our ability to help fund Phase 3D could evaporate.

The AMSAT Board of Directors plays a crucial role in setting the organization's policies. It is not a figurehead group. Members must be prepared to put in a considerable amount of volunteer work and to assume significant responsibility. No one should aspire to a seat on it because of any misplaced notion that it is an "honorary" position. Nor should we, as members, cast votes for people in order to "honor" them. By voting for someone, you are asking and expecting him or her to do a lot of volunteer work on your behalf over the next two years. Please keep these thoughts in mind when reviewing the biographies of the various candidates, especially the records of each as AMSAT volunteers. For a summary of how the organization is governed, see the article by our Corporate Secretary Martha Saragovitz, which appears in this issue.

PRO-2006 Scanner As A Satellite Receiver

by Bruce M. Marshall N4USH
bmm1@freenet.scri.fsu.edu

A few years ago I bought a PRO-2006 scanner receiver with the hopes that I could use it to receive the OSCAR satellites. As it turns out this versatile programmable scanner can be used in the downlink for all the digital satellites to date. This receiver is available from Radio Shack in the USA for \$399.95 list. Here are the modifications and operating procedures that I have used with the PRO-2006 scanner for use as the downlink receiver for the digital OSCAR satellites.

First of all, in response to several questions, the PRO-2006 will receive 1200 baud AFSK (typical terrestrial packet and DOVE DO-17 (145.825 MHz) telemetry) without modification. Simply connect the external speaker jack to a TNC. Any TNC that will work with terrestrial packet BBSs will demodulate DO-17 telemetry. A 2 meter antenna typical of that used for FM voice or packet will suffice. DO-17 also transmits synthesized voice messages (FM) on the same frequency. I use a couple of adapters that came from Radio Shack to adapt my type N and PL-259 coax connectors to the PRO-2006's BNC antenna jack. I don't think that the little telescoping antenna will pick up DO-17 well enough to demodulate much telemetry.

My next attempt at satellite reception was PACSAT AO-16. This satellite transmits 1200 baud PSK modulation. In addition to the PRO-2006 I use my HF rig, a Kenwood TS-430S, and an L.L. GRACE DSP-12 TNC. Since the PRO-2006 doesn't demodulate single sideband I use it as a very wide band down converter feeding signals to my HF rig. This is a very simple modification. I tapped off the cathode of D33 with a 10pF capacitor and a few inches of RG-174 coax to a phono/video type connector that I added to the back panel. D33 is inside the top cover about 3 inches back from the front panel and 2 inches over from the left side of the linear PC board. The glass-cased diode is end-mounted and the cathode is the end pointing up.

This gives you access to the 455 kHz final IF signal just prior to the PRO-2006's demodulator circuitry. The signal has a bandwidth of about 8 to 10 kHz. My HF rig has a transverter input on the back that I connect this signal to. You could also connect it directly to the HF rig's antenna jack but if you were to accidentally key the HF transmitter the PRO-2006 would be toast! Next tune your HF rig to 455 kHz upper sideband and, using AO-16 as an example, the PRO-2006 to 437.050 MHz. Because the signal bandwidth is at least 8 kHz you can tune your HF rig to cover much of the Doppler shift during a pass. When your HF rig's dial reads 451 kHz you will be receiving 437.046 MHz. The DSP-12 and other PSK TNCs use a phase locked loop to track Doppler shift by generating "mic click" signals. You send these to your HF rig. This setup will work with AO-16, WO-18, LO-19, FO-20 and IO-26, although I haven't tried IO-26.

440 MHz signals are subject to much more attenuation in the coax than 144 MHz signals. I needed 50 feet of coax to get above the trees and even with very high quality coax (4XL) I needed a mast

mounted preamp. The preamp made a huge difference.

The above modification also lets you use your HF rig's entire front-end, including the signal strength meter, at any frequency that the PRO-2006 will receive. Try listening to some of the odd signals across the bands in SSB or with your HF rig's FM section. Very interesting.

Next I was ready to tackle the 9600 baud FSK satellites. This requires an additional modification, as simple as, and much like the one described above. 9600 baud FSK data contains wave form components that are too high in frequency to make it through the audio amplifier section of most, if not all, radio receivers. This, by the way, leads to the rather confusing fact that if you tune in to a 9600 baud FSK signal you will not hear anything that sounds like 1200 baud AFSK or PSK. What will happen is that the signal will solidly break the squelch but it will sound very much like background noise. "T" the output from this modification to an oscilloscope, however, and you can readily see the difference. With experience you can hear the difference as well.



Make this modification exactly like the last one but leave out the capacitor. Solder the center conductor of the coax to TP2. That's it. TP2 is located about one quarter of an inch toward the left front corner of the PC board from diode D33 where the previous coax was terminated. It looks like an end-mounted resistor with no bands on it and the top lead cut off short. Run this signal to the 9600 baud FSK input of your TNC. Tune to a 9600 baud satellite and if everything worked at 1200 baud you should have no problem at 9600.

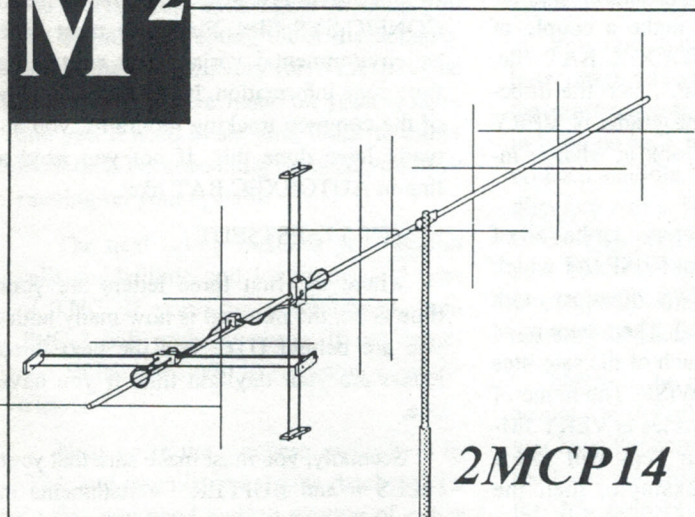
There is a serendipitous feature of the PRO-2006 that provides automatic Doppler compensation with 9600 baud FSK. I will use UO-22 which transmits on 435.120 MHz as an example. The PRO-2006 has 10 programmable "limit search"

memories (enough for 10 satellites). Program the upper limit of search to 435.130 MHz and lower limit to 435.110 MHz. Then press the down arrow so that the search progresses from higher to lower frequencies, the direction of Doppler shift. Set the squelch at about one and a half and the radio will lock onto the signal when the satellite comes into range, then follow the Doppler shift until it goes out of range. When the signal fades deep enough to return to search mode the search wraps around and locks on again within fractions of a second after the signal returns. Use the delay option to minimize return to search mode. With the frequencies for each satellite programmed into a different limit search memory you can change satellites with the press of a single button.

Considering the price of radio equipment I think the PRO-2006 with these modifications gives you very good "bang for the buck". Many people already own an HF rig and a 2 meter rig by the time they decide to get into the satellites. All mode 440 MHz rigs are quite expensive and AO-21 is the only low earth orbit satellite with a 440 MHz uplink. Good luck.

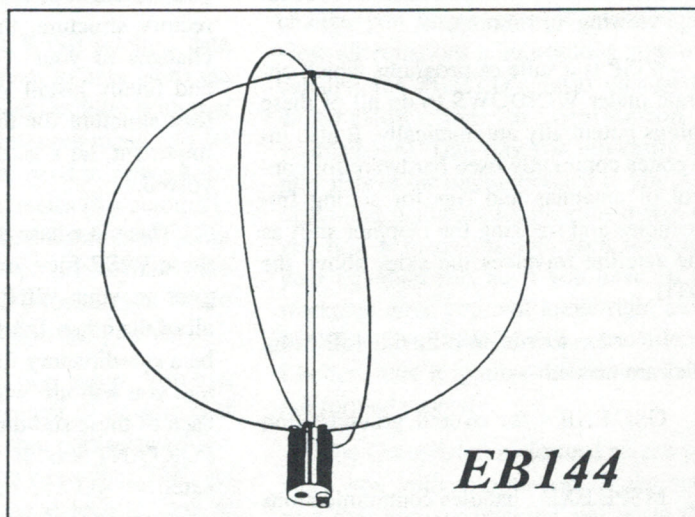


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WiSP

by Buzz Gorsky, WH6I

WiSP is a truly wonderful new suite of programs for operating the digital satellites. It was written by Chris Jackson, ZL2TPO and is the first widely used alternative to PB and PG which in one iteration or another have been around (and have been a great working mainstay) since the digital satellites began. Except for FO-20 all of the other digital satellites have required specialized software to use with the on-board software. In the recent past this has meant PG to upload files, and PB to obtain (by broadcast) directories and other files. Digi users also had to have PFHADD to add headers to documents prior to upload and PHS to strip the headers from downloaded files and retrieve the original material. To make things run smoothly many used some sort of post-processing software which might have been in the form of an actual program, or a simple or complex batch file to process, uncompress, and sort the downloaded material for reading, viewing, or running.

WiSP is a suite of programs which operate under WINDOWS to do all of these things potentially automatically. It also integrates commonly used hardware for control of antennas and rigs for setting frequencies and tracking the Doppler shift as the satellite traverses the skies above the QTH.

In order to run WiSP, the following files are needed —

- GSC.EXE - for overall groundstation control
- MSPE.EXE - handles communications with the sats
- MSGMAKER.EXE - used to compose outgoing messages
- MSGVIEW.EXE - used to read incoming messages
- VIEW-DIR.EXE - allows you to keep track of what's on the birds
- PROCMail.EXE processes incoming messages and files
- SATELLITE.DLL - necessary dynamic link library

As well as PIF files for PKZIP and LHARC, and of course a WiSP.INI file (this is WINDOWS after all). There is also a WiSP.HLP file which provides the hypertext style of help function which usually gives you just the information you need for the thing you're trying to do. With these WiSP will run. There are also two equation files not unlike the PB.EQN files we've grown used to from PB/PG. One of these works with VIEW-DIR and one with MSPE to govern how files can be sorted in the directory and how files are labelled for automatic downloading (or ignoring). The full suite of files also includes a short document on how to set up the system, and a listing of the current files and their dates. Since the system has been in an ongoing on-line beta testing mode, there have been many re-issues of the original files. In fact Chris has sometimes updated all of the major files more than once a week!

To get this software up and running you should first create an appropriate directory structure, then make a couple of changes to your AUTOEXEC.BAT file, and finally install WiSP. Since the directory structure for the programs is VERY important, let's take a look at what is involved.

There is a base directory that has all of these WiSP files (except WiSP.INI which goes in your WINDOWS directory with all of the other .INI files). Then there must be a sub-directory for each of the satellites that you will use with WiSP. The name of each of these sub-directories is VERY IMPORTANT too. If your keys will call a satellite AO-16, for example, then the

WiSP subdirectory for this satellite MUST be called \WISP\AO-16. \WISP\AO16 just won't do! Nor will \wisp\pacsat! Further, since the directories for these items must be entered into a dialog box window in the GSC setup, the entire directory name with the path must fit in the box. Therefore it's recommended that you place the WiSP directory just off the root directory and then the satellite directories just off the WiSP directory. If you use a C drive then, the WiSP directory will be C:\WiSP and pacsat's directory would be C:\WiSP\AO-16. You need a similar directory for each satellite. I also have a C:\WiSP\FILES directory in which I keep old versions of the program files (in case one comes along that seems not to work) and other items and suggestions I find on the birds that I think might be useful in the future.

After the directories are set up the next step is make a couple of minor alterations to your AUTOEXEC.BAT and CONFIG.SYS files. First, you must have an environmental variable set containing time zone information. If you are using any of the common tracking programs, you already have done this. If not you need a line in AUTOEXEC.BAT like:

SET TZ=EST5EDT

where the first three letters are your time zone, the numeral is how many hours you are behind UTC, and the next three letters are your daylight time if you have one.

Secondly, you must make sure that your FILES = and BUFFERS = statements in

Groundstation Control							
Setup	Housekeeping	Tracking	Database	Programs	Help		
11:59:49 LOC	Satellite	P	EI	Start Time	Finish Time		
K0-25	K0-25	2	75	13-07-94 11:56:56	13-07-94	12:10:57	
00:11:08 LOS	K0-23	1	9	13-07-94 19:45:01	13-07-94	19:59:37	
 View Dir							
 MsgMaker							
 Map							
Satellite	Azm	EIe	Range	MA	Mode		
K0-23	106.5	-62.3	12734.1	42.7			
K0-25	18.9	19.0	1822.5	15.3			

Figure 1: Groundstation Control Screen

your CONFIG.SYS file are large enough. Chris recommends a value of 70 for each:

FILES = 70

BUFFERS = 70

Finally, you must make certain that the program SHARE is loaded in your AUTOEXEC.BAT file. Do this by adding the following statement.

SHARE /F:4096 /L:75.

Now you are ready to begin the setup routine for the files themselves. From Windows you select FILE ADD and GROUP to add the WiSP program group, and then within that group you select FILE ADD PROGRAM to add each of GSA, MSPE, VIEW-DIR, and MSGMAKER. The other programs need not be added as they are accessed from other WiSP programs.

Then it's time to run GSA and begin the set-up process in earnest. The Groundstation Control screen is shown in Figure 1. There is a SETUP item on the menu, and it's best to go through each of the items in the list that is produced when you select setup. In the general setup you can begin by accepting all of the defaults, except that the directory for WiSP must be whatever you have made on your system, and you'll need to set your clock to either local or UTC depending on what you have running on your system.

The next set-up includes your station callsign, latitude and longitude, and type of TNC. If yours isn't mentioned, then TNC-2 will probably work. If not someone on the birds will likely know what the trick is.

Next go to the database menu item in GSA and establish a satellite database. To do this you need a clean version of either an AMSAT or NASA set of keps for the satellites of interest. The utility SORTKEP.EXE which has been on the birds will take a set of NASA keps and trim out all of the extraneous lines of text. If you don't have that utility, then it is important to clean out all of the irrelevant lines manually. Each satellite in a NASA set, for example, should have just three lines, the first begin the satellites name and the next two being the actual elements. Use an editor to delete all the lines in the file that come before the first set of elements, including the lines that are included to tell

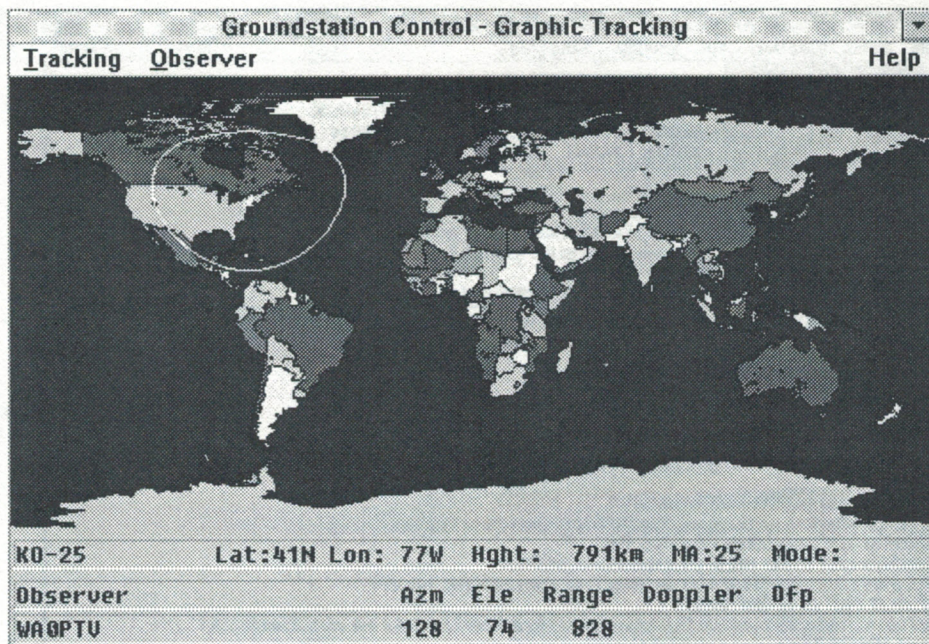


Figure 2: Graphic Tracking Display

you what the individual items mean. It will also simplify things to delete the satellites which won't be used with WiSP. Then copy that kep file into the WiSP directory. From the satellite database item you can create a new database from that kep file.

You now have a WiSP satellite data base which you can refer to in order to see the exact name for each satellite. With that in hand go back to the setup menu and set up each satellite. You need to provide the directory name, frequencies (for automatic tracking), a priority, and information about your TNC modes if appropriate. Make sure to complete both the directories and info sections for each satellite that you add.

Next do the com port setup. You can accept the defaults except to be sure that you have the correct com port selected and the baud rate that you have your TNC set for. It's probably a good idea to look at the rest of the setup menu items, but at first you can probably live with any of the defaults, and you might not want to reset everything until you've had some time to play and see how things work out for you. If you know that you need a special setting for your TNC to let your transmitter settle down, or a special timing function, then use the TNC setup to take care of those. Otherwise the defaults are all quite reasonable and conservative. When you are sure that things are working, you can change some things to try to get everything optimized.

Don't worry too much initially about the equation files. Just as with PG/PB, the equation files are fussy, so for starters either use what is uploaded with the files, or use someone else's files that work, and then make modifications a bit a time. One change you might wish to make in the view-dir equations is substituting your own callsign for ZL2TPO's (also change the destination line to destination = yourcallsign). This way you can easily display lists of messages directed to you. One nice thing is that as MSPE runs it will tell you how it made out with each section of your equation file, so if you have an unworkable error you will know right away. MSPE will run even if there was an error. I believe that it ignores the section that is not formed properly.

The Groundstation Control screen provides you with information on the satellites that you are tracking and when they will next rise. The three buttons along the left hand side also provide you with ready access to the directory viewer (View-Dir), the message maker (MsgMaker) and a tracking map so that you can see where the satellite currently is and what its footprint looks like (see figure 2). WiSP is designed to interface with the KCTracker, the JAMSAT/TAPR trakbox and other automated tracking systems.

When WiSP is running everything works together just like one would hope WINDOWS software would. GSC knows

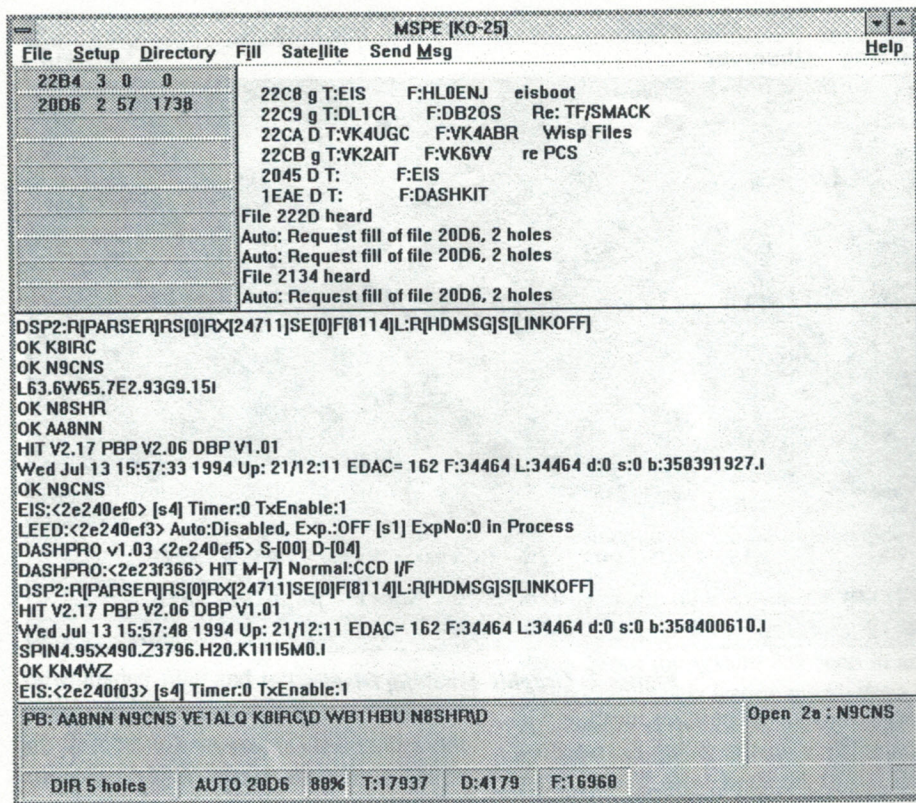


Figure 3: MSPE Running During KO-25 Pass

when orbits are coming and will either start MSPE or ask you if you want to run the orbit (depending on how you've set things up). Figure 3 shows MSPE running during a KO-25 pass. When running, it asks for directories and files according to your equations and uploads anything that is supposed to go to that satellite. The amazing thing is that it can do both at the same time! This is a huge advance over PB/PG since with that suite you could run PG and upload or PB and download, but not both at the same time. While the MSPE screen looks quite a bit like the screen in PB, it adds a number of new features. The broadcast queue is clearly displayed in the window toward the bottom of the screen and at the right edge you can see who (if anyone) is currently uploading to the satellite. The percentage at the bottom of the screen gives you an idea of the quality of your path from the satellite. Figure 3 was taken very early in the pass with total bytes received of only about 18K. As the satellite rises my percentage gets very close to 100 percent.

Because this is a windows program, you can run MSPE in one window and VIEW-DIR in another window. You can mark files from the directory to be downloaded at the same time that a pass is go-

ing on. Your instructions will then be carried out by MSPE. If you type fairly quickly, you can even compose a response during the pass and have it uploaded by MSPE. Operating digital satellites is ideally suited to a multitasking environment since most often you really do want to have several things going on at the same time.

The directory viewing screen for KO-25 is shown in figure 4. Note in the upper

left hand corner it says "changes to the directory". This shows only those directory entries which have been recently accumulated. By clicking on this box it could be changed to "images" or "all files" or any subset of characteristics that you have placed in your VIEW-DIR.EQN file. The directory lists the file number (in hex) and a range of characteristics about the file. The percentage column shows what percentage of this file has been downloaded. If it is 100 percent and it is a text file, the entry is changed to MSG. If you double click on any MSG file, the Message Viewer comes on and displays the contents of the file (see figure 5). If you do a left mouse click on any file you are provided with a listing of what is in the pacsat file header for that message. Note that the first message in the list is highlighted. If you highlight a message the buttons at the top of the screen (eg., P or A) allow you to mark the message for downloading.

After a pass has ended, MSPE automatically quits and calls PROCMAIL to process all of the .DL files (the raw file format used by the satellites) and place them in the proper directories appropriately decompressed.

As messages to you come down WiSP can be programmed to automatically open the message viewer so you can see them. So, for example, if you run your station unattended, when you first look at your computer each day, you will be presented with the messages to you that have been downloaded.

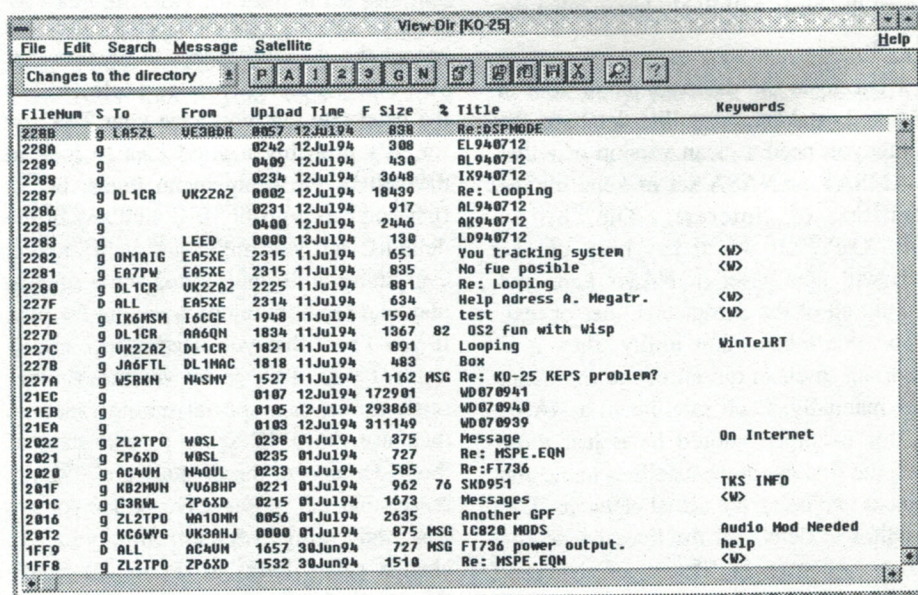


Figure 4: View Directory Screen

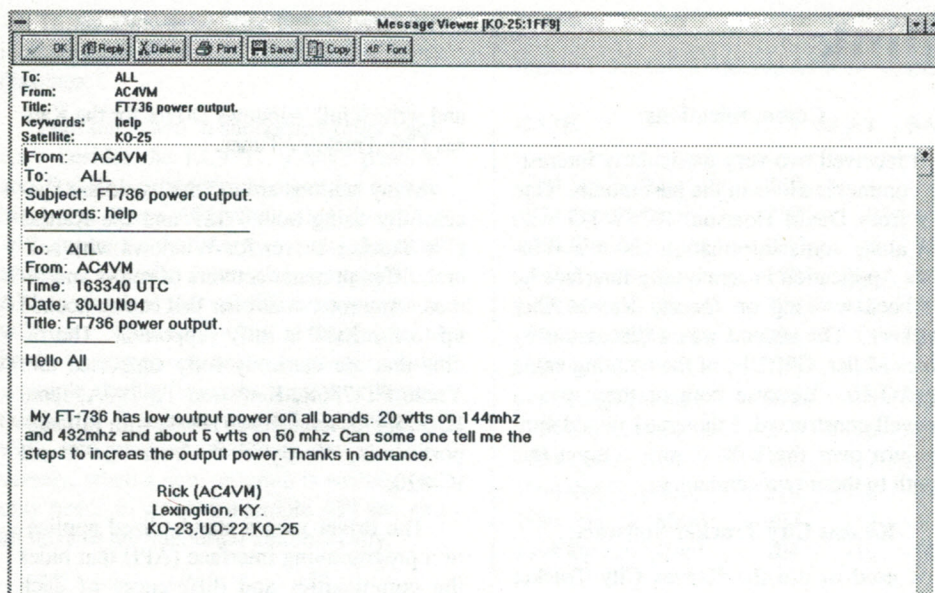


Figure 5: Message Viewer Screen

WiSP is a very professional suite of programs with the look and feel of well written WINDOWS material. Chris has offered the programs to the satellite community for beta testing by uploading successive versions on KO-23 and KO-25. In addition to reading what must be a hundred items every day from users around the world, Chris patiently answers each question, doing his best to help people with DOS problems, OS-2 Problems, Dr. DOS problems, Windows problems, TNC problems, radio problems, and of course WiSP problems too. He has been helpful to all, and always a gentleman, even with the occasional writer who is sure he knows a better way to do something. Chris has also listened to a lot of suggestions, and it's fun to read a comment saying "it would be nice if my call was in red in the queue list on the satellite" one Monday, and have new MSPE on Tuesday with that feature running! Try that with the usual software companies!

Chris is a 27 year old electronics technician who became a ham in 1989 in order to work the amateur satellites. Chris says that WiSP has so far taken 7 months of spare time work. It is written in C and is about 28,000 lines long!!

The WiSP program suite is available directly from the satellites themselves. You can try it out to see if you like it, but then you need to register it by paying a registration of US\$30 (it is also available from

other AMSAT organizations around the world... contact them individually about pricing). You can, in fact, even buy it over the phone. Call Martha at AMSAT HQ and charge the donation to AMSAT and she will give you your registration number over the phone. You then put in your registration number and you are off and running. If you do not currently have access to the

digital satellites, AMSAT will also ship you a copy with the most recent code.

However, please be advised that this program is still developing. The frequent updates make any version that you buy today obsolete within a few weeks. You do not need to pay an additional registration fee to get updates, but it is a good idea to download updated software from the satellites as it becomes available.

The equipment required to run WiSP is fairly modest. You must have an IBM compatible computer capable of running windows. It does run very well on machines as humble as a 386DX/40 with a math coprocessor. Given the nature of the orbital calculations that are involved my guess is that if you are going to run it on something less than a 486 you ought to plan on adding a coprocessor. Fortunately prices continue to fall. At Dayton, coprocessors for 386DX/40's were available for under \$30.

At this time WiSP is far and away the best amateur satellite groundstation software that has ever been produced. If you are active on the Pacsats and you're not running WiSP, you are probably working too hard.

Dallas Remote Imaging Group

Satellite Image Consulting

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Heard on the Downlink

by John Hansen, WAØPTV
49 Maple Avenue
Fredonia, New York 14063

The Space Symposium

Have you made your reservation for Orlando yet? If I could only attend one amateur radio function a year I would pick the AMSAT meetings over all the others without a moment's hesitation. Even Dayton isn't as valuable an event as the annual Space Symposium. Here's the place where folks gather to dream the dreams and find the answers. Last year we got to see Ed Krome operate his mode S station from the middle of an open field. We got to hear James Miller explain how AO-13 command stations work. We saw how to use a computer sound card to set new records in the ZRO test. We were treated to the latest in Global Positioning System technology. At least three different guys were wandering around with laptop computers demonstrating new software. And on and on.

You can be sure that there will be a large number of high quality papers presented at the meetings in October, but that's only the beginning. You'll not only hear the latest on Phase 3D... you'll see it... complete with a tour of the Spacecraft Integration Facility on Sunday morning.

But honestly, the most important part of the Space Symposium has absolutely nothing to do with technical presentations or tours. For three days you can meet, ask questions of, and listen to folks who know things that you want to know. And this is true whether you are just getting started in satellites or whether you've been hacking at it since OSCAR 6.

If you've been meaning to go the Symposium for some years now and haven't yet gotten around to it there are several good reasons that this should be the year. First, there actually will be some Phase 3D hardware there to look at. Second, since it's going to be in the Orlando area, there will be lots for the rest of your family to do, should you decide to bring them along. And finally, have you looked at air fares lately? Last year it was rather expensive to attend Dallas because the cost of flying seemed to be at an all time high. This year (at least at this writing) they are about as cheap as I've ever seen them. I suspect you can get a round trip ticket to Orlando from just about anywhere east of the Mississippi for under \$250.

Communications

I received two very particularly interesting communications in the past month. One was from David Hoatson, KC6WYG who sent along some information about a Windows Application Programming Interface he has been working on for the Kansas City Tracker. The second was a discussion by James Miller, G3RUH, of the pointing angle for AO-10. Because both of these pieces are well constructed, I thought I would simply turn over the bulk of my column this month to these two gentlemen.

Kansas City Tracker Software

I used to use the Kansas City Tracker exclusively. This presented a small problem for me because the computer that was running the Tracker was also multitasking under Desqview. I never did get this arrangement to work properly with all of the applications running on the same computer. Occasionally the rotors would "run away" and bang against their stops. Also I occasionally had problems with the transmitter "locking on". More on this below. I solved this problem by dropping the KC Tracker into a separate computer... an old 8088 based machine. I understand N6KK's drivers for the KCTracker solved many of these problems when using Desqview. That didn't help those who wanted to run Windows though. And with WiSP now available, running the KCTracker under Windows becomes a much more immediate concern. However, it seems Windows and TSR (terminate and stay resident) programs don't get along very well. Put differently, in Windows, all programs are TSR's in some sense, but they must conform to Windows rules. Thus the ultimate answer to this situation would be to write Windows-specific drivers for the Kansas City Tracker. With this background, consider the following communication from David Hoatson, KC6WYG:

I thought that I would drop you a line and let you know of some recent developments with using Windows and the KCT/T. First, let me give you some history. I have been active on both the analog and digital satellites for about a year. I have both a Kansas City Tracker / Tuner and a TAPR TrakBox. When I started seeing messages on the 9600 baud birds from Chris Jackson, ZL2TPO about his upcoming WiSP software, I figured he could use some software that I had been developing to support the KCT/T with Windows. After a few messages back on forth over the birds, I decided to go ahead

and write a full Windows Driver for the Kansas City Tracker / Tuner.

Many stations around the world are successfully using both WiSP and the Kansas City Tracker Driver for Windows with several different manufacturers of rotors and radios. Any rotor controller that can be hooked up to the KCT is fully supported. The radios that are currently fully supported are: Yaesu FT-736R, Kenwood TS-790A, Icom IC-275/475, Icom IC-271/471, with full support coming shortly for the Icom IC-970 and IC-820.

The driver uses a standardized application programming interface (API) that hides the complexities and differences of each piece of hardware from the application. When I was laying out the API for the driver, I decided to make three different levels of APIs.

With the Level One Interface, an application need only call a few functions like: RotorSetPosition, and the antennas are pointing in the right direction and the radio is tuned for the doppler shift. The application just calculates the correct doppler frequencies and rotor positions, and the driver takes care of everything else.

The Level Two Interface was going to be like the DOS TSR Time/Table interface, but after discussing it over with Chris, I decided not to implement this interface.

The Level Three Interface will be full tracking support like the TrakBox. The application only needs to hand the driver a set of keplerian elements and tell the driver which satellites to track, then the driver starts tracking those satellites without any further intervention from the application. This frees the application to present the user with other information required to make contacts, and not be concerned about the communications link itself.

I have "donated" all proceeds of the software to AMSAT. (This means that included in the driver package is a note saying that you can use the software for free for 30 days on a trial basis, after that you should donate \$10 to AMSAT).

I am keeping all of the source code for the driver and only release "developer's kits" to application programmers that are interested in using the driver with their programs. There is no charge for the developers kit. I am doing it this way to keep the API from changing out from underneath already established programs.

To my knowledge Roy Welch, WØSL is including the driver with all registered WiSP diskettes.

I am interested in supporting other hardware besides the KCT/T. I have plans to add TrakBox support right away (as soon as the Level Three APIs are nailed down). I will support other hardware as the need arises. I am also interested in making the APIs a standard that all Windows programs will use. This way when a new piece of hardware comes out, one only needs to write a simple device driver to support a limited number of functions, then all existing software will work on that new device. Conversely, when a new program is written, one only needs to write to a simple API set, and all devices are supported automatically.

73!

David A. Hoatson, KC6WYG

AO-10 Pointing Angle

The following was received from James Miller, G3RUH:

Satellite operators frequently ask "what is the attitude of OSCAR-10", or "can I have ALON/ALAT values for my computer program". Well, it looks like eleven year old AO-10 is coming good again. Here's the analysis.

When the computer failed on OSCAR-10 in 1986 we knew approximately what its orientation was. Since then of course there has been no telemetry, and the only "measurements" we can take are subjective interpretations of transponder performance and beacon wobbles.

At the time it finally failed, the spin axis/ antenna direction lay exactly on the Sun's orbital arc (the Ecliptic). So because of the Sun's annual motion the solar panels were in turn fully lit then completely dark, twice a year. The Sun's angle to the panels just cycled up and down a sawtooth from -90 to 0 to +90 to 0 to -90. As you would expect, at zero illumination conditions the battery flattened, the beacon disappeared and there was no transponder. Exactly what we see to this day.

Also at the time it failed it was spinning at some 30 rpm. Due to tiny frictional effects this spin was gradually falling at a rate of 0.0035 rpm/orbit, so the current (1994) spin rate is very low.

Now a spinning satellite is just a gyroscope, and in the absence of any torques, should stay pointing in the same direction for all time. So one can extrapolate from the last known (1988) direction to the present

Figure 1: Predicted Attitude for AO-10, 1994-1996

DATE	ALON	ALAT	SA	ILL%	SEL	SAZ	Arg P	RAAN
1994 Jan 24 [Mon]	240	-5	17	95	-1	167	149	345
1994 Feb 21 [Mon]	237	-7	45	69	-6	192	156	340
1994 Mar 21 [Mon]	233	-9	73	27	-10	217	164	336
1994 Apr 18 [Mon]	230	-10	78	20	-11	242	171	331
1994 May 16 [Mon]	227	-12	51	62	-8	266	178	327
1994 Jun 13 [Mon]	224	-13	24	91	-1	289	186	323
1994 Jul 11 [Mon]	221	-14	-2	99	7	311	193	318
1994 Aug8 [Mon]	218	-15	-29	87	16	334	200	314
1994 Sep5 [Mon]	215	-16	-56	55	21	359	208	309
1994 Oct3 [Mon]	212	-17	-83	11	20	26	215	305
1994 Oct 31 [Mon]	210	-18	-68	36	13	51	222	300
1994 Nov 28 [Mon]	207	-18	-40	75	0	74	230	296
1994 Dec 26 [Mon]	204	-19	-12	97	-13	96	237	292

DATE	ALON	ALAT	SA	ILL%	SEL	SAZ	Arg P	RAAN
1995 Jan 23 [Mon]	201	-19	16	96	-25	121	244	287
1995 Feb 20 [Mon]	199	-19	44	71	-30	150	252	283
1995 Mar 20 [Mon]	196	-19	72	29	-27	179	259	278
1995 Apr 17 [Mon]	193	-18	79	18	-15	203	266	274
1995 May 15 [Mon]	190	-18	52	60	0	223	274	270
1995 Jun 12 [Mon]	188	-17	25	90	17	242	281	265
1995 Jul 10 [Mon]	185	-17	-1	100	32	265	288	261
1995 Aug7 [Mon]	182	-16	-27	88	39	295	296	256
1995 Sep4 [Mon]	179	-15	-54	57	34	326	303	252
1995 Oct2 [Mon]	176	-14	-82	13	20	351	310	248
1995 Oct 30 [Mon]	173	-12	-70	34	0	9	318	243
1995 Nov 27 [Mon]	170	-11	-41	74	-20	27	325	239
1995 Dec 25 [Mon]	167	-9	-13	97	-37	51	332	234

DATE	ALON	ALAT	SA	ILL%	SEL	SAZ	Arg P	RAAN
1996 Jan 22 [Mon]	163	-8	15	96	-45	87	340	230
1996 Feb 19 [Mon]	160	-6	43	72	-37	122	347	225
1996 Mar 18 [Mon]	157	-4	71	31	-19	145	354	221
1996 Apr 15 [Mon]	154	-3	80	16	2	161	2	217
1996 May 13 [Mon]	150	-1	53	59	24	177	9	212
1996 Jun 10 [Mon]	147	0	26	89	42	200	16	208
1996 Jul8 [Mon]	143	2	0	100	49	236	24	203
1996 Aug5 [Mon]	140	4	-26	89	40	271	31	199
1996 Sep2 [Mon]	136	6	-53	59	21	293	38	195
1996 Sep 30 [Mon]	133	8	-80	16	-0	308	46	190
1996 Oct 28 [Mon]	130	10	-71	32	-23	324	53	186
1996 Nov 25 [Mon]	126	12	-43	72	-42	348	60	181
1996 Dec 23 [Mon]	123	14	-14	96	-50	27	68	177

Key

ALON deg	Attitude longitude in orbit plane coordinates (BLON)
ALAT deg	Attitude latitude in orbit plane coordinates (BLAT)
SA deg	Sun Angle
ILL%	Percentage illumination = 100*COS(SA)
SEL deg	Sun's elevation above orbit plane
SAZ deg	Sun's azimuth in orbit plane coordinates

Orbit plane coordinates: longitude is measured clockwise from perigee; latitude is measured up from the orbit plane.

Current Amateur Satellite Frequencies

Satellite	Callisgn	Uplink	Downlink	Type
AO-10		435.03-435.18 LSB/CW	145.975-145.825 USB/CW	Mode B Analog
AO-13		435.423-435.573 LSB/CW	145.975-145.825 USB/CW	Mode B Analog
AO-13		435.603-435.639 USB/CW	2400.711-2400.749 USB/CW	Mode S Analog
FO-20		145.9-146.0 LSB/CW	435.9-435.8	Mode J Analog
AO-27		145.85 FM	436.80 FM	Part-Time Repeater
AO-21		435.016 FM	145.987 FM	Part-Time Repeater
RS-10		145.865-145.905 USB/CW	29.360 - 29.400	Mode A Analog
RS-12		21.21-21.25 USB/CW	29.41-29.4	Mode K Analog
AO-16	PACSAT	145.90, .92, .94, .96 FM	437.0513 SSB	1200 Baud PSK
DO-17			145.825 FM	1200 Baud AFSK/ voice
WO-18			437.104 SSB	1200 Baud PSK (img)
LO-19	LUSAT	145.84, .86, .88, .90 FM	437.1258 SSB	1200 Baud PSK
FO-20	8J1JBS	145.85, .87, .89, .91 FM	435.91 SSB	1200 Baud PSK
UO-22	UOSAT5	145.9, .975 FM	435.12 FM	9600 Baud FSK
KO-23	HL01	145.85, .90 FM	435.175 FM	9600 Baud FSK
KO-25	HL02	145.98 FM	436.5 FM	9600 Baud FSK
IO-26	ITMSAT	145.875, .90, .925, .95 FM	435.822 SSB	1200 Baud PSK
POSAT	POSAT1	145.975 FM	435.2777 FM	9600 Baud FSK

- 1) Frequencies shown are without Doppler compensation. For typical digital satellite pass the original signal will be about 8 kHz higher than what is shown.
- 2) WO-18 Webersat transmits experimental and image data and can be captured in KISS mode via PB or TLMDC.
- 3) Except for FO-20 the digital sats use a program suite containing PB/PG/PFHADD/PHS or WISP. The broadcast callisgn (in PB.CFG) is the satellite's callisgn with an SSID of -11. The connected mode callisgn (in PG.CFG) is the satellite's callisgn with an SSID of -12.
- 4) When in mode JD, FO-20 can be worked with any packet program. Connect to 8J1JBS. FO-20 currently alternates between modes JA and JD on a weekly basis. Check ANS bulletins for schedule.
- 5) AO-10 is no longer controllable but the transponder works when the satellite is in sunlight.
- 6) For AO-10 and AO-13, transmit LSB, receive USB. As transmitted frequency is increased the received frequency will decrease (inverting transponder).
- 7) AO-21 currently operates on a 10 minute schedule with FM repeater, WEFAX image transmission, and 1200 baud AFSK telemetry in each cycle.

day and beyond. The key phrase here is "absence of any torques"; if the spin rate is falling there must be some coaxial torque at least, and there is no reason not to expect some non-coaxial torques which would change the orientation a little.

So with the forgoing caveats, Figure 1 shows the predicted attitude of OSCAR-10 based on the last known 1988 data. The pattern is likely to be more or less correct, but by now there is probably a few week's slippage. The only way to find out is to use the satellite and correlate experience with expectation. If users will take the trouble to let me have their observations we can together almost certainly refine this table. But

I am not going to do it on my own.

It looks to me as though we are in for some near "normal" times on AO-10 for a couple of years. Bear it in mind during those irksome periods when OSCAR-13's attitude is so unsociable.

Transmitter Lock

The CAT port of the Yaseu 736 is a bit finicky, to say the least. Occasionally the transmitter locks on. When this happens it cannot be corrected simply by turning the radio off and on. Instead it is necessary to actually do a microprocessor reset using the switch through the hole in the top cover of the radio. And since I started using a

Trakbox, this won't even work if the Trakbox is on and connected to the radio. Instead I have to unplug the CAT line from the Trakbox to the radio and then reset the microprocessor.

I have heard some speculate that this odd behavior occurs when the 736 somehow doesn't see the entire command sequence coming through the CAT port. For example, it can happen if you turn the radio on when a command is coming from the Trakbox. What ever causes it, it seems to be related to turning one box on or the other. It has never happened to me (fortunately) when I have not been in the shack. Since I rarely turn the radio off, this is not a particularly seri-

Satellite Orbital Elements

by Ray Hoad, WA5QGD

Satellite	AO-10	UO-11	RS-10/11	AO-13	FO-20	AO-21	RS-12/13
Catalog Number	14129	14781	18129	19216	20480	21087	21089
Epoch Time	94195.81899517	94199.48919451	94197.30647920	94196.85984906	94196.43656308	94197.22316383	94198.89454776
Element Set	290	708	926	931	705	489	708
Inclination	27.0497	97.7853	82.9266	57.7662	99.0371	82.9454	82.9212
RA of Node	317.9184	212.7468	307.3174	241.7882	342.9206	121.2318	348.6696
Eccentricity	0.6025942	0.0011606	0.0010629	0.7219935	0.0539924	0.0036264	0.0030577
Arg of Perigee	194.3808	164.4932	309.9250	345.8198	275.4857	5.6499	25.1580
Mean Anomaly	135.3303	195.6634	50.0970	1.7627	78.4920	354.5058	335.1056
Mean Motion	2.05882029	14.69230442	13.72339165	2.09720171	12.83226347	13.74542090	13.74043567
Decay Rate	-.00000239	.00000098	.00000024	.00000217	-.00000018	.00000094	.00000022
Epoch Rev	8335	55490	35390	4661	20775	17357	17286
Satellite	UO-14	AO-16	DO-17	WO-18	LO-19	UO-22	KO-23
Catalog Number	20437	20439	20440	20441	20442	21575	22077
Epoch Time	94198.24542996	94195.78079047	94199.72060632	94197.73736895	94196.24430425	94198.77455892	94198.40713031
Element Set	10	808	809	811	807	512	407
Inclination	98.5893	98.5977	98.5990	98.5989	98.5998	98.4336	66.0825
RA of Node	282.6137	281.4443	285.6692	283.7090	282.4984	272.6530	216.7082
Eccentricity	0.0011828	0.0012030	0.0012218	0.0012786	0.0013130	0.0007314	0.0015129
Arg of Perigee	100.6891	108.0022	96.2295	102.3306	106.5314	193.2332	279.4774
Mean Anomaly	259.5624	252.2471	264.0280	257.9303	253.7309	166.8641	80.4534
Mean Motion	14.29849660	14.29903339	14.30043483	14.30017383	14.30113337	14.36923567	12.86286995
Decay Rate	.00000013	.00000010	.00000023	.00000012	-.00000013	-.00000012	-.00000037
Epoch Rev	23388	23354	23412	23384	23364	15747	9067
Satellite	AO-27	IO-26	KO-25	POSAT	MIR	NOAA-10	NOAA-11
Catalog Number	22825	22826	22830	22829	16609	16969	19531
Epoch Time	94198.16297797	94197.16066415	94197.23470784	94197.66078408	94199.14525698	94201.86328615	94201.84751066
Element Set	305	305	310	298	684	780	701
Inclination	98.6525	98.6521	98.5530	98.6462	51.6466	98.5077	99.1768
RA of Node	273.6702	272.7178	269.7323	273.2405	31.5281	209.8364	191.5874
Eccentricity	0.0009098	0.0009803	0.0012471	0.0010944	0.0001914	0.0012246	0.0012810
Arg of Perigee	116.6352	121.7855	90.3363	108.5827	139.9218	229.7166	40.6400
Mean Anomaly	243.5760	238.4287	269.9244	251.6545	220.1916	130.2942	319.5723
Mean Motion	14.27629544	14.27733649	14.28060091	14.28033511	15.56612283	14.24898582	14.13004374
Decay Rate	.00000015	.00000010	.00000014	.00000024	.00005683	.00000081	.00000123
Epoch Rev	4196	4182	4184	4190	48084	40729	29989

ous problem, but it could be if the equipment came back up after a power failure. While I'm still not sure exactly what is causing the problem the probability of it occurring seems to be reduced if I turn the radio on first and then turn on the Trakbox. If you've run across this problem or (even better) have found a solution, please drop me a note.

New Telemetry Programs Now Available

Walt Daniel, KE3HP passes along the following information:

John Magliacane, KD2BD has written a simple DOVE telemetry decoding program for MS-DOS computers. It is available on the Internet by ftp from pilot.njin.net in the

pub/SpaceNews/software directory. The program processes telemetry that was captured as text files and can direct the output in engineering units (volts, degrees, etc.) to the monitor, printer, or another text file.

In that same directory is an MS-DOS telemetry program for AO-27 that was written by John Teller N4NUN. While DOVE uses standard 1200 bps packet for telemetry, AO-27 requires a TNC in KISS mode. The program can receive data in real time from the satellite through the TNC as well as display telemetry from a disk file. One of the unique features of the program is that the telemetry coefficients can be updated using information transmitted by the satellite.

Don't forget that AMSAT Headquarters has MS-DOS telemetry programs available. TLMDC II decodes telemetry from the four Microsats and there is also a program available to process AO-13 PSK telemetry. See "AMSAT Software Library" in the March/April issue of the Journal for details.

Joe Kasser, W3/G3ZCZ recently released a new version (1.30) of his comprehensive MS-DOS telemetry program called WHATS-UP. This shareware program can decode data from many amateur satellites currently in orbit. WHATS-UP doesn't seem to be available on the Internet, but Joe's PC-HAM telephone BBS (301/593-9067) always has the latest version.



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Notes from the Field...

Phase 3D Progress Report

by Philip Chien, KC4YER
3206 South Hopkins Ave. #40
Titusville, FL 32780
PCHIEN@IDS.NET

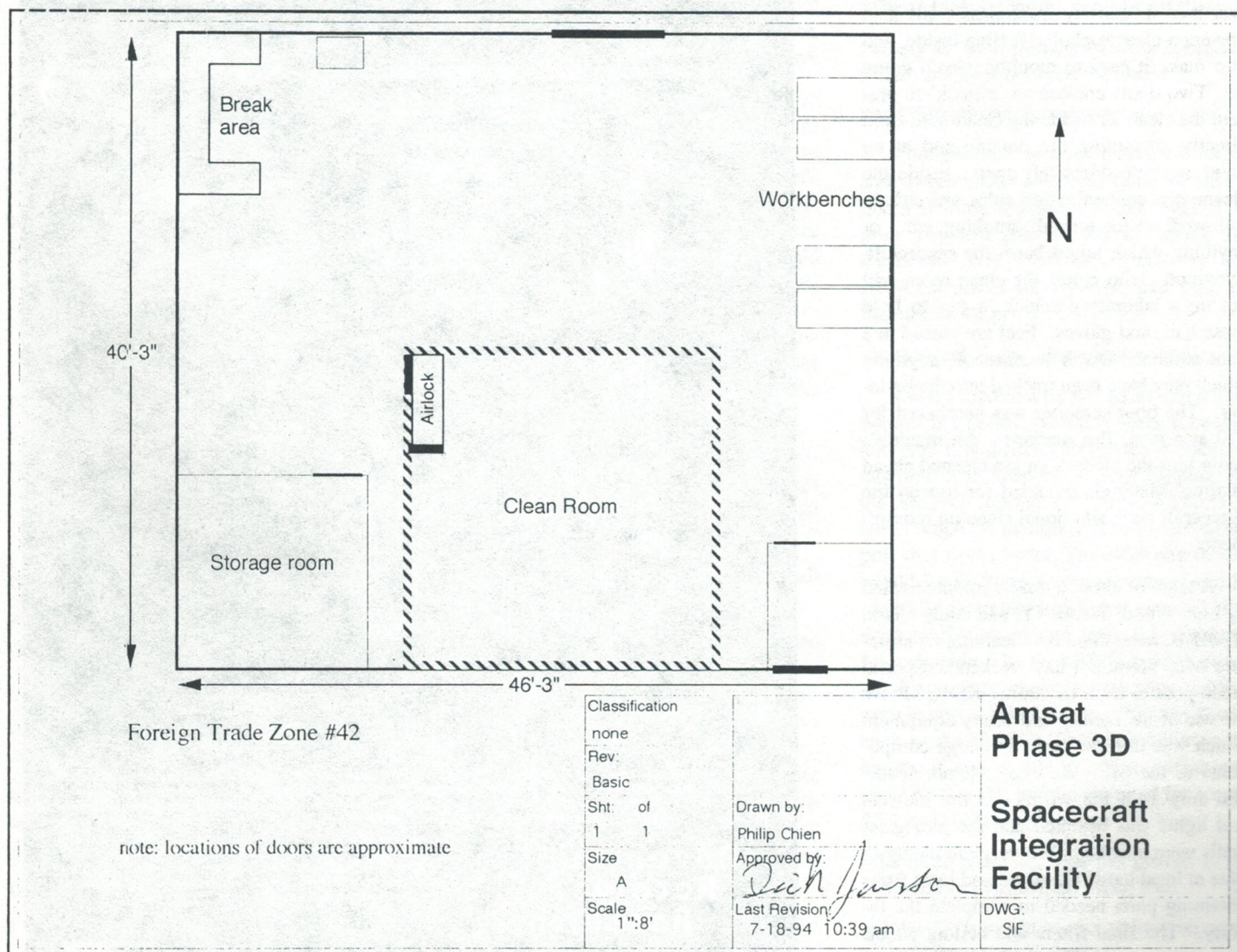
When I volunteered to work on Phase 3D I didn't have the faintest idea what I was getting myself into. The decision had been made to integrate the separate sub-assemblies from around the world in the Foreign Trade Zone at Orlando International Airport. A Foreign Trade Zone (FTZ) eliminates the requirement to pay customs duties for value-added products. Normally we would have to pay \$\$\$ to U.S. customs based on the fair market value of all of the components imported into the U.S. - even though the integrated spacecraft would be

shipped out of this country when completed! With a FTZ, local businesses benefit from the labor and other services which are provided. Phase 3D will be the first spacecraft to be processed in Foreign Trade Zone #42 at the Orlando International Airport.

The first flight components to arrive in Florida were the Russian-built propellant tanks. The tanks were shipped from Russia to AMSAT-DL for inspection. From Germany the tanks were shipped to Orlando. Over the next year we will be receiving additional spacecraft components from Germany, Japan, Finland, United Kingdom, Slovenia, the Czech Republic, Belgium, Hungary, and South Africa among other countries.

Our Spacecraft Integration Facility is an existing building which was originally part of McCoy Air Force Base. Many years ago BD (Before Disney), Orlando was a medium size town served by a downtown airport, and a few commercial flights into McCoy. After the Disney explosion McCoy was converted into a commercial facility and quickly grew into one of the most used international airports. (By the way - this explains why your luggage tags to Orlando are marked MCO). We are planning on an open house at the Spacecraft Integration Facility during the October AMSAT symposium.

I expected to work on the spacecraft, but quickly found out that before you can



put together a spacecraft, you have to put together a facility and a cleanroom. Hitachi Data Systems donated a 20 foot by 20 foot class 10,000 cleanroom which arrived in many separate components on a semi-trailer. A class 10,000 cleanroom has no more than 10,000 5 micron or larger particles per cubic foot of air. In practice the Phase 3D spacecraft will not require that clean a facility, and we expect to operate the facility as a class 100,000 cleanroom. This is still much cleaner than a hospital operating room. The roof of the cleanroom has eight fans with extremely fine filters which will capture dust and other airborne particles. If we purchased the filters from the manufacturer it would cost over \$10,000. So we assembled our own filters out of commercial filters, similar to the filters in your home's airconditioner — for less than \$500.

The cleanroom always has more pressure inside than outside to prevent dust from entering. At least one fan will be running constantly, with more fans running whenever there is activity. Plexiglass walls help prevent a claustrophobic feeling inside, and also make it easy to monitor what's going on. Two doors enclose an 'airlock' to prevent the clean air inside the cleanroom from directly contacting the outside and at no point are both doors left open. Inside the cleanroom contamination rules are strictly followed: no food, drink, smoking, etc. - or anything which might harm the spacecraft. Everybody who enters the clean room will put on a laboratory smock, a cap to hold loose hair, and gloves. Feet are placed in a boot scrubber which brushes off anything which may have been tracked into the building. The boot scrubber was purchased for \$10 at a local flea market! All materials taken into the cleanroom are cleaned ahead of time. Materials intended for use on the spacecraft have additional cleaning requirements.

A team of about a dozen volunteers, led by Stan Wood, WA4FNY, and Andy Clark, KE4IXU, assembled the cleanroom's structure over Memorial day weekend. Special credit goes to Dick Divittorio, KB4QKP, for the use of his facility and heavy equipment which was used to move the large components to the SIF. Between Memorial day and July 14th the wiring for the blowers and lights was installed and the plexiglass walls were attached. We've spent plenty of time at local hardware stores and local firms obtaining parts needed to complete the facility. The final filters and ceiling panels

were in place by the 14th, just in time for the spaceframe's arrival from Weber State University on July 19th. Over 1,000 man hours went into just setting up the facility.

Over the next couple of weeks the spaceframe will be disassembled and the panels to be painted will be sent out to a local paintshop. Special primers and paints which are qualified for spacecraft use (e.g. won't outgas in a vacuum) will be used. After the panels come back from the paint shop they will be reconnected to the spaceframe. Over the next two years the

propellant tanks, batteries, transponders, antenna farm, and other components will be mounted on the spacecraft.

If you're going to be in the Central Florida area this summer, give us a call at the SIF at 407-859-2344 and we'll put you to work.

I'm looking forward to working on the spacecraft, wiring harness, and modules payload over the next two years - but will always remember that to put together a spacecraft you first need a place to put it together!

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P50VD	50-54	< 1.3	15	0	DGFET	\$29.95
P50VDG	50-54	< 0.5	24	+12	GaAsFET	\$79.95
P144VD	144-148	< 1.5	15	0	DGFET	\$29.95
P144VDA	144-148	< 1.0	15	0	DGFET	\$37.95
P144VDG	144-148	< 0.5	24	+12	GaAsFET	\$79.95
P220VD	220-225	< 1.8	15	0	DGFET	\$29.95
P220VDA	220-225	< 1.2	15	0	DGFET	\$37.95
P220VDG	220-225	< 0.5	20	+12	GaAsFET	\$79.95
P432VD	420-450	< 1.8	15	-20	Bipolar	\$32.95
P432VDA	420-450	< 1.1	17	-20	Bipolar	\$49.95
P432VDG	420-450	< 0.5	16	+12	GaAsFET	\$79.95

Inline (rf switched)						
SP28VD	28-30	< 1.2	15	0	DGFET	\$59.95
SP50VD	50-54	< 1.4	15	0	DGFET	\$59.95
SP50VDG	50-54	< 0.55	24	+12	GaAsFET	\$109.95
SP144VD	144-148	< 1.6	15	0	DGFET	\$59.95
SP144VDA	144-148	< 1.1	15	0	DGFET	\$67.95
SP144VDG	144-148	< 0.55	24	+12	GaAsFET	\$109.95
SP220VD	220-225	< 1.9	15	0	DGFET	\$59.95
SP220VDA	220-225	< 1.3	15	0	DGFET	\$67.95
SP220VDG	220-225	< 0.55	20	+12	GaAsFET	\$109.95
SP432VD	420-450	< 1.9	15	-20	Bipolar	\$62.95
SP432VDA	420-450	< 1.2	17	-20	Bipolar	\$79.95
SP432VDG	420-450	< 0.55	16	+12	GaAsFET	\$109.95

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Groundstation Diagnosis

A newcomer to satellites recently posted a message to the amsat-bb mailing list on the Internet. He asked about what kind of equipment others had in their stations. As is common on the Internet, he got a flood of responses. Because this is a question of interest to a lot of new (and not so new) AMSAT members, we have included here most of the "thread" of this discussion. This material is included largely in an "unedited" format because we felt that it was useful to also preserve the "flavor" of life on the information highway. Please note that the views expressed below are solely those of the authors and do not necessarily represent the view of AMSAT as an organization or the *AMSAT Journal*.

From: Michael Malloy
<mmjimm@post.its.mcw.edu>

Subject: Hello

I am new to ham radio and satellite radio communication. I recently joined AMSAT-NA and would like to meet others in this exciting hobby. I would also like to know something about what kind of satellite stations people on this list are using to help me plan my purchases. Looking forward to hearing from many of you.

73 de N9WJV

From: srbible@cs.nps.navy.mil (Steven R. Bible)

Subject: Re: Hello

In his posting Michael Malloy says:

< I would also like to know something about
< what kind of satellite

< stations people on this list are using to
< help me plan my purchases.

And Clinton WB8ORM says:

< Me too. The equipment and antennae are
< not inexpensive and it only makes

< sense to learn from the experiences of
< other amateurs. With the indulgence

< of the list, I would appreciate seeing the
< replies to his posting as well.

< Many thanks

I think that there are several people who are willing to help you guys, however, it would help us if you state which satellites you would like to communicate with.

If you choose AO-13 then the equipment will be more elaborate and expensive. AO-13 is a low signal satellite that requires higher gain antennas and receive pre-amplifiers. With this equipment you can work any of the satellites in the amateur inventory and even terrestrial VHF/UHF SSB low signal work, and even a little EME.

If you choose the digital satellites there are two categories: MicroSats and UoSats. The MicroSats are 1200 baud PSK satellites that require SSB and FM transmit and receive radios. An all mode SSB radio is more expensive than an FM radio. Antennas are not as elaborate, so there is some savings there. These satellites will, hopefully, in the future be switched to 2400 baud PSK (they are already capable, however, typical ham earth stations are not. It requires a new modem).

UoSats require two FM transmit and receive radios (less expensive), however these satellites run at 9600 baud which requires modification to the radios to do 9600 baud. The newer radios coming on the market are advertising 9600 baud ready but I would caution anyone in purchasing these until there is some user reports and magazine reviews. The other trouble with these new 9600 baud radios is that the 440 MHz ones do not tune to the 435 MHz portion of the satellite band.

Be careful in your purchase of any radio. We need to give you a list of the things desired in a satellite radio before you go out and buy.

If you want to wait for P3D then all you will need is a handi-talky :-)

So help us help you. Don't forget to do some reading. AMSAT has very good user booklets on how to get started on AO-13 and the PACSATS. They are inexpensive and the money goes to building satellites. The ARRL Handbook and the Satellite Experimenter's Guide are good reads. Each of these pubs talk about equipment and they even give model numbers of possible used radios to consider.

73 Steve N7HPR

From: srbible@nps.navy.mil (Steven R. Bible)

Subject: For Mike and Clinton

This is for Mike and Clinton who asked what kind of equipment people were using for the OSCARs. Here's a repost to a discussion we had on amsat-bb some time ago concerning antennas. I thought that at least this might help them (and whoever else was interested) in their purchasing decisions.

Steve N7HPR

I thought I would put in a plug for the Hy-Gain Oscar Antennas also...

Dave, WB4SBE/8 writes...

>I've had good luck with the Hy-Gain
>Oscar-Link antennas. You can get them

>singly or as a package with a fiberglass
>mast that goes between the booms

>and through the elevation rotor.

I bought mine as a set, both the 2-meter and 70-centimeter antennas, and a fiberglass boom (I think it's about 5 feet long). The price you will pay for this set verses the Cushcraft AOP-1 set or collectively the KLM set places the Hy-Gain pair right in the middle for price.

A word about Fiberglass booms...

I can't recommend the KLM fiberglass boom - it's hollow, you can break it easily, and thus it is difficult to tighten the antennas onto it to keep them from slipping. In the AMSAT Journal Vol. 16 No 4 I believe Ron, W8GUS, mentions a solid fiberglass pole that works better. The other alternative would be to force a wooden dowel inside the KLM fiberglass boom, but you will still need to find a way to keep the antennas from slipping. The Hy-Gain boom has metal reinforcements where the antennas and the rotor clamp, a better design. The only drawback to the Hy-Gain fiberglass boom is its length. If you decide to add a 2.4Ghz antenna or two you will be cramped for room. Still, the Hy-Gain boom can't be beat.

>the more usual 20. This has proven to be
>sometimes marginal on Mode J on

>Oscar-13. It would be nice to have an extra
>S-unit from time to time.

I've only worked AO-13 on mode B. I've always had good signal reports. Naturally, on the LEO birds the Hy-Gain pair has more than enough gain. In fact, if all you plan to work is the LEO birds then consider the Cushcraft AOP-1. AO-13 does need the antenna gain. It is more important to get good antennas and preamps than worrying about what radio you are going to use. I personally use the Kenwood TR-751/851's.

>from. However, when the 70 cm antenna
>gets wet, the rain droplets bridge the

>elements to the metal boom across the
>speed-washers and shoulder insulators.

> ...

>a roof over their antennas to stop this prob-
>lem).

I too noticed a difference when the antenna is wet, but at those higher frequencies you most certainly will. I once lived in sunny Western Washington :^) across the bay from Seattle but never had any major problems due to the wet weather. I never heard of building a roof over them!

>since the antennas don't balance at the nor-
>mal place when the coax is

>connected to the rear of the antenna (ap-
>parently no one at Hy-Gain thought

>about the effects of the weight of the coax
>on the balance point). The 2-m

>antenna is not a problem here — just move
>the clamp to a different point > ...

>U110 "elevation" rotor didn't have the
>"oomph" to elevate the system.

I moved the mount for the 2-meter beam and left the 70-centimeter one right where it was at. I too have the U-110 and it never had a problem. Still, I would have liked for the antennas to be better balanced. Just remember that your antennas spend most of their time pointing at an angle. The greater oomph is needed right where the antennas are horizontal and the leverage is at its worst. I use my satellite antennas for terrestrial communications and even for VHF contests, thus the horizontal position is useful. Trailing the coax from the end does change the balance point of the antennas. Little did I realize! I balanced the antennas before I wired them and had to go back and shift the mounting point.

The Yaesu G-5400 az/el rotor is fantastic. I just wish I could afford one. I've helped two others put up an oscar system

and they both had the Yaesu. It's easy to install and maintain (see Heard on the Downlink in AMSAT Journal Vol 16 No 3 for cold weather info). If you decide automatic tracking is needed, the interface for the Kansas City Tracker is simply a plug and play operation. The KCT and 5400 are a perfect match and work well. It's nice to have the computer do the tracking while you worry about talking to the bird.

>should mention that running the coax back
>up the boom to the mast is a

>no-no with circularly-polarized antennas —
>it messes up the antenna patterns.

Read the latest findings in the latest AMSAT Journal. Seems the antenna range at the yearly AMSAT meeting found out that this is not necessarily true.

>Rather than using separate preamps and
>T/R switching relays, I use the

>Tokyo Power Labs in-line RF-sensing pre-
>amps. The Landwehrs (sp?) are probably

Again, for the price the Landwehrs are the way to go. After you consider the price of say the ACC best unit (which has better noise figure and better gain than the Landwehr) add coax switches since they are not inline for more than 25 watts, and weather proofing you quickly come to see the Landwehr making more sense. They handle 150 watts rf switched, 750 watts switched. They come ready to mount to the mast, weather proofed and all.

>circular polarization. You typically only
>lose an S-unit when talking with

>other vertically- or horizontally-polarized
>terrestrial stations, and tend to

>be more immune from polarization-rotat-
>ion fading effects (one of the main

>reasons for using circular polarization for
>satellite use).

I wish someone would explain the truth about this. I talked easily into Oregon on 2 meters SSB. I used them during numerous VHF contests. I contend that I did as well as the big guys. I sure could hear good and I was only running a barefoot Kenwood TR-751 at 25 watts.

Hope this helps. I am very pleased with the Hy-Gain OSCAR antennas. They make a good price to performance choice. I've also helped install KLMs and they are nice too but read up on them, especially how to improve their weaknesses like open switch

relay (40CX), drilling holes in the radiating elements to allow water to drain, just to mention a few.

It might even be nice to list all the articles so others could reference them. Any- one for a FAQ sheet for OSCAR?

Best of 73, Steve, N7HPR

From: Larry_Kollar@technet.sa.com

Subject: Re: Satellite Stations

Michael Malloy:

< I would also like to know something about what kind of satellite

< stations people on this list are using to help me plan my purchases.

Clinton (WB8ORM):

>Me too. The equipment and antennas are not inexpensive...

I've made several fine contacts on RS-10 and RS-12, using equipment and antennas that cost less than \$300 (per satellite).

RS-12 uplink (15m):

- Heathkit HX-1681 CW transmitter (\$150 used including matching receiver) - G5RV antenna (\$30) [use a dipole cut for 15m and spend even less]

RS-10 uplink (2m):

- Kenwood HR-2600 all-mode (\$180 used) [10W CW/SSB]

- homebrew 3/4-wave vertical (\$1.75)

10-meter downlink:

- Hammerlund HQ-170 receiver (\$75) [original receiver] Rat Shack 10m rig [current - traded the Hammerlund for it] - homebrew turnstile antenna (\$15) [wire elements with bamboo supports]

With this setup, I can reliably get a CW signal up to either bird whenever they are in range. For SSB operation, 10W is a bit marginal. It works OK whenever the elevation is between 20 and 50 degrees (which happens to be the theoretical radiation angle of a 3/4-wave vertical). 15 minutes is enough to get in two or three short QSOs, even on CW.

In my experience, it's much easier to work low-orbit birds if you just use omnis. An 11-element beam works great... if you

have one hand for the mike, one hand to adjust for Doppler, and two hands to turn the az-el rotor controls. I don't know about y'all, but I'm two hands short. :-)

I plan to add a Hamtronics 435 MHz preamp and 435->28 converter to the 10-meter rig so I can work FO-20. (See my summary article posted earlier this week — if you missed it, let me know & I'll send you a copy.) That should run < \$100. I'm hoping to work RS-10 and FO-20 from batteries on Field Day.

If you shop around and won't turn your nose up at used equipment, it should be possible to get on AO-13 for less than \$1000. I'm not speaking from direct experience — but I've missed chances at two Yaesu FT-726 rigs, one at \$675 and the other at \$700, in the past year. If you're one of the guys who beat me to it, that leaves \$300 for antennas — I think I remember seeing something plenty adequate advertised for less than that. Build your own antennas and save.

When Phase III-D goes up, the costs could drop even further if the bird performs as advertised (less required ERP = smaller amps, antennas, or both).

Anyway, it's not as expensive as you might think. A little ingenuity can make satellite work no less affordable than HF.

From: "Walter K. Daniel KE3HP"
<wk02593@worldlink.com>

Subject: Gear for starting a satellite station

Here are two approaches for starting a satellite station based on my experience of the past few years. Perhaps the most important beginning point is reading *The Satellite Experimenter's Handbook* (TSEH) from the ARRL.

1. Digital satellite reception, spacecraft telemetry

If you are mostly interested in receiving information from digital satellites, you can easily begin with DOVE (DO-17). The gear needed for DOVE will also allow you to receive SAREX, Mir, and AO-21 transmissions. Transmitting to the Shuttle or Mir is possible if you don't mind odd hours or if you invest in a beam antenna (see "You, too, can contact space!" by Michael Bass N7WLC/5 in the May/June 1993 issue of *The AMSAT Journal*).

The three components you need are a 2m FM transceiver, a 2m antenna, and a packet terminal node controller or TNC. I started off with an HT (Kenwood TH-27A, about \$300 new), but any decent 2m FM rig will work. Start with an omnidirectional antenna such as a quarter-wave ground plane. You can build one (see TSEH for details) or buy one such as the MFJ-1740 for about \$13. My first TNC was a PacComm HandiPacket portable, but any VHF TNC such as the MFJ-1270 (about \$120) is fine. Of course, you need a computer to use with the TNC.

DOVE transmits packet telemetry and messages on 145.825 MHz. You can also receive traffic from the Mir packet mailbox on 145.55 MHz. In recent years, the cosmonauts haven't been using voice much, but you're suitably equipped if they do. The Shuttle sometimes carries SAREX (Shuttle Amateur Radio Experiment) and can transmit packet or voice on 145.55 MHz. In addition to its FM repeater and digital voice downlinks, AO-21 has been transmitting some packet telemetry on 145.987 MHz recently. Finally, you can also work terrestrial packet and 2m voice for repeaters and nets.

If your long-term goal is to work the Pacsats, you can plan ahead for 9600 bps FSK operations. Some of the new FM rigs have 9600 bps modem connectors so you don't have to perform surgery on the radio. You can buy a PacComm TNC with the 9600 bps modem installed for a bit over \$200, not too much more than the cost of a TNC. The versatile DSP boxes cost much more (over \$500), but offer capabilities to work many digital modes including 9600 bps FSK.

2. Analog (voice and CW) operation

If you are mostly interested in speaking to or exchanging CW with other hams, try RS-10 Mode A and/or RS-12 Mode K. For more details, see my article "Getting Started with RS-10" in the August 1993 QST or the article by Robert Capon WA3ULH "Working Satellite RS-12..." in the February 1994 QST.

For reception of either satellite, any HF or 10m rig will work. I have a used Uniden HR-2600, but you can still buy them new for \$200. A 10m dipole antenna works well—build your own or buy one (about \$20). To transmit to RS-10, you need a 2m rig with CW and USB modes. These rigs are not as common as FM rigs and cost a

bit more. My Kenwood TR-751A cost about \$600 new. To transmit to RS-12, you need to use the 15m band. The RS-12 transponder input lies in the Advanced/Extra class subbands, so make sure you have the privileges before you transmit.

The RS-10 CW beacon at 29.357 MHz is strong. The RS-12 CW beacon is also strong at 29.408 MHz. Operation on these satellites is full duplex (you hear yourself from the satellite), so headphones are necessary. If you have a 2m multimode rig like I do, you can work other non-satellite modes: 10m voice or CW, 2m FM voice for nets and repeaters, 2m terrestrial packet with a TNC, and terrestrial 2m SSB or CW weak-signal operation.

The addition of a 70cm antenna (\$60 for a small yagi) and a 70cm-to-10m downconverter (about \$100) will turn a Mode A station into a Mode JA station. The only satellite currently operating JA is FO-20, but Phase 3D will likely spend some time in this mode. The addition of a PSK modem (about \$200) and TNC (\$120) brings Mode JD capability for the 1200 bps Pacsats. Alternatives include the combined PacComm TNC/PSK modem (about \$270) or a DSP box.

73, Walt KE3HP

From: Ken Waters
<watersk@emh.yokota.af.mil>

Subject: Satellite ?s

I must say I've really enjoyed the recent spate of articles folks have posted in the past week on how to get started with satellites. The information content of them has been quite excellent. Someone mentioned that folks who want to get started should state what they are most interested in and what equipment they already have. So, I'll do my part and see if anyone has any ideas.

My current equipment is as follows:

HF: Icom 720A

VHF/UHF: Yaesu FT-4700 dual-band FM mobile (modified for 9600 on 430 only)

Alinco DJ1FT 2m handheld

Plus a good array of receivers, to include the Icom R-7000, Yubi FVT-7100, and Yaesu FRG-9600, all capable of receiving several modes incl SSB.

I do -not- currently have a TNC.

My goal is (in order of importance):

1. work satellite packet (at any speed)
2. work terrestrial packet
3. work satellite voice
4. work HF packet (AMTOR??)

All this....without spending a lot of \$\$\$s!
The big decision I see is what TNC to buy. Is there a TNC around that can offer me both satellite packet (at 9600) -and- terrestrial packet (1200/9600) without having to buy umpteen add-on boards and having to do lots of modifications? Does anybody have any suggestions? Will I have to buy two TNCs...one for 9600 satellites only, and one for terrestrial?

73 de Ken/N4PBY/KA2KW/ex-HL9PIT
nr Tokyo, Japan

From: harper@huntsville.sparta.com
(Christie Harper)

Subject: satellite stations

I started out with the following:

Yaesu 736-R

KLM-14C downlink

Rutland 22 element vertically polarized (15 dBd gain) uplink Landwehr preamp on 2m

Antennas mounted on 7 foot high mast sitting in a Radio-Shack tripod. Crossboom was a 1 3/4 inch wooden stair rail. Azimuth and Elevation set by hand. I used short feed lines (< 20 feet (6 m)) and was able to work AO-13 and AO-10 quite successfully. LEO sats were not tried with this setup.

For azimuth measurement I used two yard sticks and a protractor connected together. One of the yard sticks is set to point due north. The other yard stick is set to the proper azimuth (using the protractor) and the antennas are turned until they line up. For elevation I found a tilt indicator (used for roofing work) at Home Depot for about \$8. Tilt the antennas until the correct elevation is set and you are ready (correct about every 15-30 minutes).

Since then I have added a Mirage D1010N amp (10 watts in 100 out) and the Yaesu 5400B rotor. The addition of the amp

allows for a good to excellent downlink signal during any part of the orbit (much easier to get my downlink signal to match the beacon now). Normally about 30-50 watts is all that is needed. I added the rotor because of changes in my antenna system. I have gone to linearly polarized antennas on both the downlink and uplink. My downlink antennas are now 2x12 element Rutland (fo-144-12) antennas, which are 18 feet long making it a little difficult to reach the boom (crossboom is now about 11 feet off the ground). I notice a little more spin modulation from AO-13 at high squint angles but it is quite livable. Uplink is 2x22 Rutland (22 element atv).

My station is very portable and only takes about 30-45 minutes to set up (antennas hang inside my garage when not in use).

Bottom line:

I like the 736-R for satellite operation. If you get interested in other VHF/UHF bands (6m, 222 or 1296) for \$200-600 you can add an additional module and have that

band also (up to 4).

There are mods for the 736-R to allow 9600 baud modem operation.

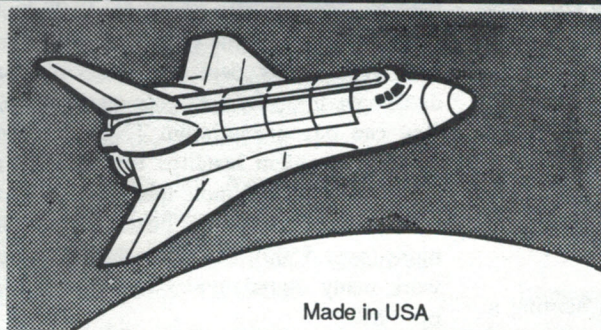
Try linear antennas if you have them, you will be surprised how well they work.

Get a good preamp. Short feedlines (< 50 feet if possible), I use a flexible 9913 coax (Flexi 4 ??) from the Wireman and have had good success.

Most of all experiment. There are several good articles on building 8-12 turn helix for uplink (ARRL Handbook, ARRL Antenna Handbook). For downlink build a 8-10 element Quagi or Yagi. For about \$20-30 you can build a decent preamp (ARRL Handbook, no RF switching) (Down East Microwave sells the GaSFET required).

AMSAT has plenty of good info on basic systems to work RS series of satellites (100 watts into a ground plane on 2m and good 10 m receiving setup will be no problem)

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DSP-93, The TAPR/AMSAT Joint DSP Program

Greg Jones, WD5IVD and
Robert Diersing, N5AHD

In July 1988, TAPR and AMSAT entered into the Joint DSP Program, in order to fund the development of an eventual DSP unit for amateur usage. As of the 1993 Dayton Hamvention, the direction of development was focused on a modular, standalone DSP system proposed by Bob Stricklin, N5BRG, in Dallas, Texas. The Stricklin KISS design, later renamed DSP-93, offered many of the things that the initial design goals of the project had specified. Fifteen months after the decision was made to proceed with the DSP-93 development, TAPR and AMSAT are both proud to announce that orders for kits will be taking place July 15th through August 31st for the first 150 units.

DSP-93 Design

The DSP-93 is designed to provide radio amateurs the wonderful capabilities of Digital Signal Processing in a standalone low-cost design. Not just limited to one mode, the DSP-93 can support data, audio, and video modes with the proper software.

DSP-93 has been designed in a modular fashion with two four-layer boards utilizing an interconnecting bus structure. The basic system includes a DSP engine board and a radio/computer interface board. The DSP Engine (the bottom board) contains the TMS320C25 DSP, 32K by 16 bits of program and data memory - upgradable to 64K, the clock circuitry (40MHz) and some programmable array logic for system I/O. The Radio/Computer Interface (the top board) contains two eight pin female mini-DIN connectors for radio interfacing. Incoming radio signals pass through a voltage divider to establish the initial levels, then through an eight channel multiplex chip. The multiplex chip then feeds the single A/D input with either of the radio inputs or one of the six auxiliary inputs. The Texas Instruments TLC32044 Analog I/O chip is used, which samples and updates at a rate of up to 45K operations per second and includes aliasing filters. This board also communicates to your computer at speeds up to 19.2K baud using a serial connection.

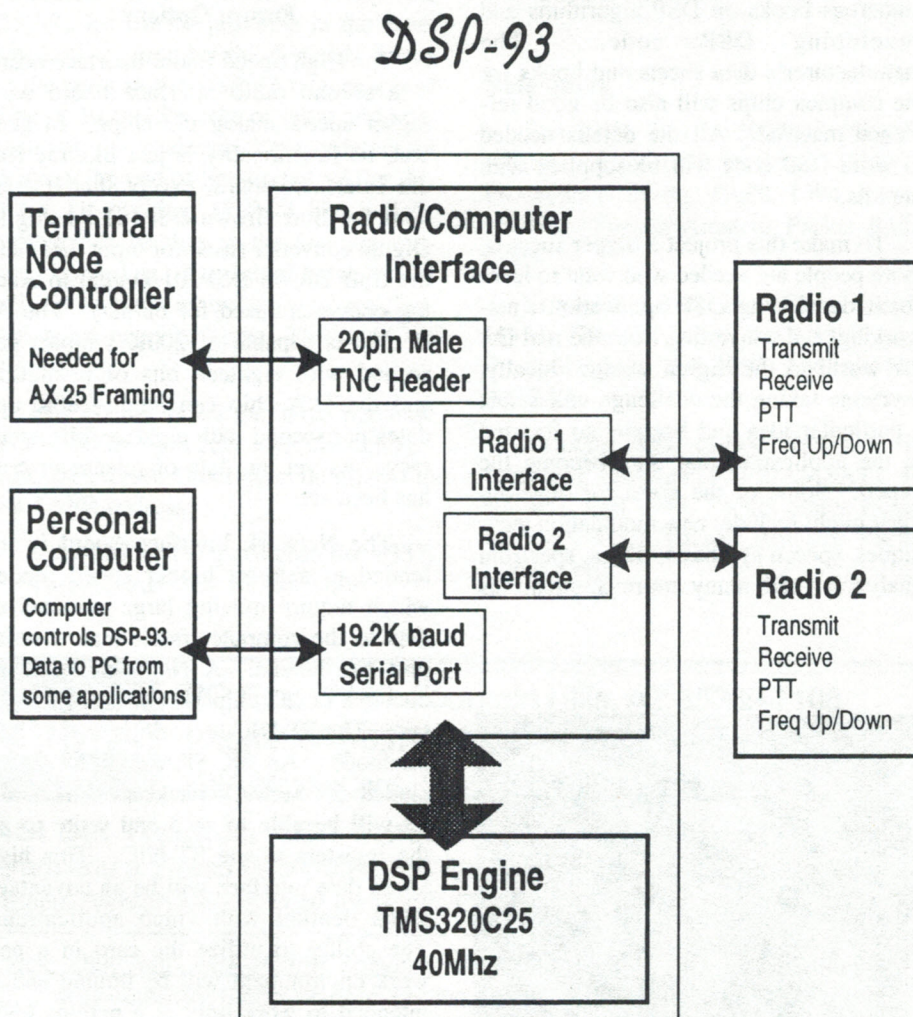


Figure 1: DSP-93 Interfaces

The modular design of the DSP-93 allows for either of these boards to be replaced with future boards designed for any number of unique applications. It's sort of like adding a new application card to a PC without redesigning the complete PC. Figure 1 is a block diagram that shows how the DSP-93 is interfaced.

Basic Software

The initial offering of the DSP-93 will contain the following software: 1200 baud AFSK, 300 baud AFSK, 1200 PSK, 9600 FSK terrestrial, 9600 FSK full-duplex for satellite operations, and various audio filters. These have been developed, tested, and have been in use during beta-testing.

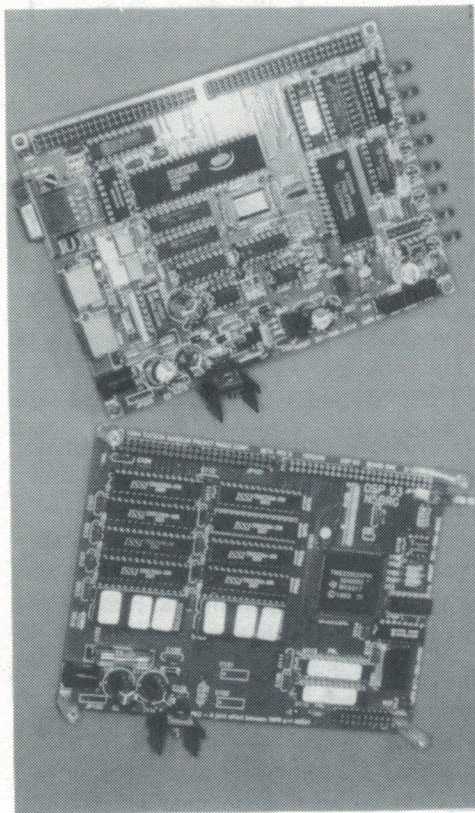
Software currently under test, which may or may not be released with the first batch of kits include: APT, Digital Oscilloscope, SSTV, and HF modes. User interface software for DOS and Windows is also under development and testing.

Future software will be distributed on Internet, CompuServe, Amateur Satellites, and other systems, as well as being made available on disk as part of the TAPR software library. The basic idea is to make it as easy as possible to get and upgrade software in the future. Since the DSP-93 is an open architecture, it is hoped that as more amateurs get their units, more software will be developed and distributed.

Code Development

A low cost shareware assembler is available for code development. To develop code for this board, you must have good reference material. You can find numerous books on DSP algorithms and developing DSP code. The manufacturer's data sheets and books for the complex chips will also be good reference material. All the details needed to write DSP code will be supplied with the kits.

To make this project a bigger success, more people are needed who want to learn about developing DSP applications, networking, and converting from the real linear world to the digital world. Ideally, everyone taking the challenge will select a particular idea and become so focused in the application that they become the expert. Some of the areas for development might include: new modulation techniques, speech synthesis, filters, spectrum analyzers, and many more applications



you will think of. If you choose to work on the hardware aspects of this project, the modular approach should allow you to convert to other DSP chips or Analog I/O chips or to add additional capability.

Future Options

The High Speed Radio Interface board is a second radio interface board with higher speed analog I/O chips. In general, its functionality is just like the Radio Interface Board, except that it contains the Burr Brown DSP101 Analog to Digital converter (used for input data) and the Burr Brown DSP201 Digital to Analog converter (used for output). The A/D chip is capable of 200K samples per second with eighteen bits of resolution and the D/A chip can attain 300K updates per second with eighteen bits accuracy. As yet, no date of release or cost has been set.

The Network Interface board is intended to support higher speed modes which require moving large amounts of data to the computer faster than a serial port can handle. A National Semiconductor ST-NIC chip was selected for the task. The ST-NIC is working in the eight bit mode. An 8K SRAM buffer is included for network packets. The DSP-93 will be able to read and write to all the registers of the ST-NIC. This high speed data interface will be an advantage when dealing with video applications. The ability to utilize the card in a network environment will be limited and is intended to work only at a netbios level with a very simple structured DSP protocol. The success of the network board will depend on the available DSP cycles left over between A/D samples after all tasks are completed. As yet, no date of release or cost has been set.

A TNC Interface board can be placed inside the DSP-93 for the decoding of HDLC frames for packet radio applications. The board provides the basic functionality required of a TNC as a low-cost option for those that require one entire unit, instead of hooking their DSP-93 to an existing TNC at the station. Again, there is currently no date of release or cost available.

The Project Team

Much of the development and current success of the DSP-93 project can be at-

tributed to the designers, developers, and testers. These include the designer, Bob Stricklin, N5BRG, the project managers, Bob Stricklin, N5BRG and Greg Jones, WD5IVD. The Joint DSP Project Officers are Robert Diersing, N5AHD (AMSAT) and Greg Jones, WD5IVD (TAPR). The Alpha-Team consisted of Bob Stricklin, N5BRG, Frank Perkins, WB5IPM, Jon Bloom, KE3Z, Lon Cecil, WB5PKJ, Tom McDermott, N5EG, Robert Diersing, N5AHD, UoSAT/Doug Loughmiller, K05I/G0SYX, John Conner, WD0FHG, Greg Jones, WD5IVD, and Bill Reed, WD0ETZ. The Beta-Team consists of Jack Davis, WA4EJR, Paul Beckmann, WA0RSE, Scott Zehr, K9GKC, Ron Parsons, W5RKN, Jim Tittsler, 7J1AJH/AI8A, Michael Zingman, N4IRR, Stan Salek, KD6CVL, Mark Hammond, KC4EBR, Marcel Losekoot, Bill Beech, NJ7P, Gould Smith, WA4SXM, Roy Welch, W0SL, Greg Ratcliff, Brian Straup, NQ9Q, Doug Howard, KG5OA, and Robert Greenfield, VE3DSC.

Any of the project members welcome questions about their work and involvement. If you know someone on this list, please ask them about their unit and how it operates. Personal contact with testers is one of the best ways to determine the unit's possible usefulness in your shack. Many of the testers are active on the satellites and so they are easy to contact.

Ordering Your DSP-93 Kit

The DSP-93 will sell for \$430 as a complete kit, including enclosure and power supply. It is available in kit form only. For those not wanting to build a kit, there are several preassembled DSP units on the market today available from other sources. Ads for these units can be found in various publications. It is our hope that the TAPR/AMSAT joint DSP-93 project will expand the use of DSP in the amateur community and become a tool for education.

TAPR kits can be complex depending on the kitting experience of each builder. We don't think you will have trouble with the DSP-93 kit, but it does require some knowledge and experience to successfully go from a kit to a finished, usable unit, depending on the mode of operations. For data radio applications (i.e. 9600 baud FSK), special modifica-

tions must be made to your radio for proper operation of the DSP-93. Unlike other TAPR kits in the past, only the interface to the radio and the serial cable to the computer (DB-9) will be the responsibility of the kit builder. All other parts will be in the kit ready for complete assembly.

Due to the cost of each unit, TAPR and AMSAT are unable to fund the total purchasing of inventory that may sit idle on the shelf for months. Neither organization can sustain such an investment at this time, with AMSAT Phase 3D developments and other such TAPR projects ongoing. To avoid this possibility, TAPR and AMSAT are requiring that kit purchasers provide VISA/MC information or checks/money orders with their initial purchases. Money for the initial kit purchase will be deposited on September 15th, 1994 to cover kitting costs, with kits being shipped beginning November 15th. If kits are available before November 15th,

they will be shipped when available. Orders will be taken for the first 150 units. If more than 150 units are ordered, then a second or third batch will be done as soon as additional parts inventory can be purchased and kitted. In this way, the DSP-93 kit will be provided in the exact numbers required for the demand. Many of the parts in the DSP-93 require a lead time of 10 to 15 weeks or more and consequently have already been ordered for delivery the end of September. After this initial kit offering, DSP-93 kits will be provided in batches as the demand warrants doing kits. The initial batch of kits will be as large as the demand requires, which we hope is large. The more the merrier!

DSP-93 orders for the initial purchase will be taken from July 15th through August 31st, 1994. Orders can be mailed to the TAPR address:

8987-309 E. Tanque Verde Rd #337,
Tucson, Arizona 85749-9399

or call (817) 383-0000 (Office Hours: Tue-Fri, 9am-12noon, 3pm-5pm Central Time), or fax (817) 566-2544. Note to TAPR members: Since this is a joint project, this kit will not have a membership discount attached.

References

Stricklin, Bob. (1994). TAPR/AMSAT Joint DSP Project: DSP-93. Proceedings of the TAPR 1994 Annual Meeting. Tucson Amateur Packet Radio Corp.

Stricklin, Bob and Greg Jones. (1993). TAPR/AMSAT DSP-93 Project. Proceedings of the 1993 AMSAT-NA. AMSAT.

Stricklin, Bob. (1993). DSP-93: The Joint DSP Program (TAPR/AMSAT). Issue #52, Fall 1993, Packet Status Register. pp. 4-5. Tucson Amateur Packet Radio Corp.

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NC	WJ9F	Russ Platte	4226 Peppertree Ave.	Concord, NC	28027	(704) 784-4949		
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OH	WB8IFM	Gerd Schrick	4741 Harlou Dr.	Dayton, OH	45432-1618	(513) 253-3993		
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IN	KB9CML	Jon Haskell	10906 Lakeshore Drive West	Carmel, IN	46033	(317) 846-2394	(317) 846-5880	kb9cml@amsat.org
IN	KD9QB	Ron Pogue	210 Westminster Drive	Noblesville, IN	46060-4242	(317) 773-4936	(317) 646-3435	kd9qb@amsat.org
IN	KE9I	Gerard Jendraszkiewicz	6838 Magoun	Hammond, IN	46324	(219) 845-8513	(312) 702-7220	
WI								
0 Call Area								
CO	K9MWM	Bob Ludtke	406 Yale Circle	Glenwood Springs, CO	81601	(303) 945-8722	(303) 945-8686	bob@cog.uu.net
IA	WB0NCR	Richard Machacek	3185 240th Street	Winthrop, IA	50682	(319) 935-3699		wb0ncr@amsat.org
KS	W0CL	Dwain Johnson	1332 Lincoln	Baxter Springs, KS	66713	(316) 856-5342	(417) 623-8000 Ex-427	
MO	W0SL	Roy D. Welch	908 Dutch Mill Dr.	Manchester, MO	63011	(314) 391-5323		w0sl@amsat.org
MO	WB0QJB	Rusty Baum	3037 Rockwood Trail	St. Charles, MO	63303	(314) 928-6583		rsb@world.std.com
MO	W0ZZQ	Max Bodenhausen	116 Dogwood Lane	Highlandville, MO	65669	(417) 587-3690		
MN	K0GA	Garfield A. Anderson (GAR)	5820 Chowen Av. S.	Edina, MN	55410	(612) 922-1160		
MN	W0QIN	R. Clark	7701 Glasgow Drive	Edina, MN	55439	(612) 944-1315		w0qin@amsat.org
MN	WD0AKO	Dale Cary	3012 18th Ave. S.	Moorhead, MN	56560	(218) 236-6324		
ND								
NE								
SD								
Canada								
	VE2LVC	Pierre A. Cicuto	5185 Boul. Notre Dame, No. 101	Laval, Quebec	H7W 1V6	(514) 973-6259		ve2lvc@amsat.org
	VE3FRH	Robin Haighton	2028 Cheviot Court	Burlington, Ontario	L7P 1W8	(905) 335-5892	(416) 747-4017	
	VE6ATS	Paul Barrow	Box 655	Devon, Alberta	T0C1E0	(403) 987-3746	(403) 492-5160	ve6ats@amsat.org
	VE7MAL	Malcolm Scrimger	1278 Rockcrest Ave.	Victoria, BC	V9A4W2	(604) 386-9443	(604) 656-0656	CIS 72600,2425
	VE7XQ	Tony Craig	20691 - 45A Ave.	Langley, BC	V3A3G3			

Area Coordinators are AMSAT members who volunteer a portion of their time to support AMSAT and their local amateur radio community. They provide an interface between AMSAT and local radio amateurs by providing information on amateur satellite communications through club presentations, AMSAT booths at local hamfests, local AMSAT nets, demonstrations of OSCAR satellite communications and Elmering satellite novices. These activities directly support AMSAT by improving the average radio amateur's knowledge of both AMSAT and OSCAR satellite operations.

Area Coordinators are needed everywhere, especially in those states or regions where no current volunteers are listed. If you are interested in volunteering as an Area Coordinator please call the AMSAT office at (301) 589-6062.

Larry Brown, NW7N
Asst. VP Field Ops.

The Democratic Process

By Martha Saragovitz - Corporate Secretary

With the 1994 ballots in the mail, I thought it useful if members have the benefit of a review of how the organization's electoral process works. The Bylaws of the Radio Amateur Satellite Corporation, the organization we know as AMSAT, clearly prescribe the procedures to be followed in conducting elections for the Board of Directors and officers. These are summarized as follows:

The membership elects the seven member Board of Directors. Four members are elected in odd numbered years and three in even years. Thus, three members are up for election this year. Board members serve for 2 years.

Nominations for the AMSAT Board can be made by any five current members or by a Member Society. The nominee(s) must be current AMSAT members and they must have expressed their willingness to serve. Nominations must be received at AMSAT

Headquarters in Silver Spring, Maryland by June 15.

Ballots must be mailed to all current members by July 15. Properly marked ballots must be received at Headquarters by September 15. The announcement of the results of the election must be made public by September 30. The candidates receiving the largest number of votes shall be declared elected to the seats being contested. The two candidates receiving the next largest number of votes shall be declared First Alternate and Second Alternate, respectively, to serve until the next annual election of Directors or as provided in Article II, Section 7 of the Bylaws. The newly elected Board members are installed at the fall meeting following the Annual Meeting, which must take place in October or November of each year.

The Bylaws also prescribe the election of Officers and establishes what Officers must exist. It stipulates that the Officers are to be elected by the Board of Directors at its fall meeting or at other meetings if a

vacancy occurs. The Officers prescribed are: President, Executive Vice President, Vice President Engineering, Vice President Operations, Corporate Secretary and Treasurer. In addition, the President is given the authority to appoint, at his or her discretion, additional officers. Note the small "o". Thus, such officers as Vice President for Manned Space Programs, Vice President for Field Operations, Vice President for Future Planning etc. have been created by various Presidents as the need arose.

Six duly executed nominations for Board of Directors were received, by the June 15th deadline, for this year's election. These nominees as follows:

Keith Baker KB1SF

Tom Clark W3IWI

John Hansen WAØPTV

Andy McAllister WA5ZIB

Lou McFadin W5DID

Bob Myers W1XT

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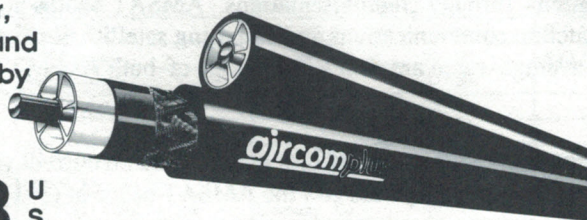
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Four other Board members were elected

Bill Tynan W3XO

I urge all members to take the time to vote. The continued health and future of the organization depends upon you.

The Founding of AMSAT - A Chronology

(From the AMSAT Newsletter, Volume I, Number 1)

Jan. 9, 1969

George Jacobs addressed a meeting of the Comsat Amateur Radio Club at Comsat (L'Enfant Plaza). Topic: The Status of Project OSCAR. During this meeting, Jacobs suggested that the Comsat Amateur Radio club help form an East Coast group to carry on the objectives of Project OSCAR.

Jan. 21, 1969

A meeting at Perry Klein's apartment was attended by Denny Avers of the IBM Radio Club, George Kinal of the Communications & Systems Radio Club, Jim Puglise and Bill Tynan of the Applied Physics Lab. Radio Club, and Perry Klein of the Comsat Radio Club. Purpose: to discuss the interest of these clubs in a joint effort to organize an East Coast amateur satellite organization. It was concluded that interest was sufficiently great that the idea should be pursued further, and it was decided to form a non-profit corporation in order to disassociate the group's activities from any of the companies with whom the members were employed.

Jan. 31, 1969

By this time a draft "Charter of the Amateur Satellite Corporation" had been circulated among a number of radio clubs in the Washington area and a meeting was held between Perry Klein and members of the NASA Goddard Space Flight Center Radio Club (Jan King, Frank Briden and Seth Williams). These club members indicated their interest in supporting the planned organization.

Feb. 6, 1969

The first large organizational meeting was held at Comsat (L'Enfant Plaza) and attended by nearly two dozen interested amateurs. George Jacobs repeated his recommendation that an East Coast amateur satellite group be established in the Washington area. A preliminary application for membership in the "Amateur Satellite Corporation" was distributed. Five members of an interim Board of Directors were appointed (Jim Puglise of APL, George

Kinal of C&S, Cap Petry of ARINC, Jan King of NASA-GSFC, and Perry Klein of Comsat). The interim Board was to accomplish the organizational and operational functions of the group until a regularly elected Board could be chosen by a general membership. The interim Board agreed to prepare and file articles of incorporation as a non-profit scientific corporation of the District of Columbia.

Feb 13, 1969

The first Board of Directors meeting took place at the Applied Physics Laboratory in Silver Spring. Purpose: to draft the articles of incorporation. It was decided to call the organization the Radio Amateur Satellite Corporation (AMSAT). After five hours of discussion, a first draft of the articles of incorporation was agreed upon.

Feb 27, 1969

A second meeting of the Board of Directors was held at APL in Silver Spring. The Articles of Incorporation, which by this time were in final form, were signed by the Board of Directors and notarized. Discussions began on a draft of the bylaws.

March 3, 1969

The Radio Amateur Satellite Corporation became officially incorporated as a non-profit scientific corporation of the District of Columbia.

March 6, 1969

The third general meeting was held at IBM in Gaithersburg, Md. The meeting was mainly a technical progress report and discussion of amateur satellite nuclear power sources, gravity gradient stabilization, and launch vehicle possibilities.

March 8, 1969

Cap Petry addressed the Washington Section of the Quarter Century Wireless Association at their annual banquet. Topic: The newly formed Radio Amateur Satellite Corporation. Along with brief announcements in April *QST* and *Autocall*, these were the first public announcements of AMSAT's formation.

March 15, 1969

A third meeting of the Board of Directors was held at Jim Puglise's home to try and finalize the bylaws for the new corporation. The meeting lasted from 5PM to nearly 4AM! Officers were elected by the Board on an interim basis: Perry Klein as President, Jan King as Executive Vice President, George Kinal as Vice President - Engineering, Cap Petry as Vice President - Operations, Jim Puglise as Secretary, and Dick Mostow as Treasurer. The Board authorized the opening of a checking account and dues were collected from the Board.

March 20, 1969

The fourth general AMSAT meeting was held at Comsat (L'Enfant Plaza). A brief progress report on the bylaws and new membership application form was given and dues were collected from the general membership for the first time. It was announced that the Board of Directors of Project OSCAR had agreed to send the Australis-OSCAR A satellite to AMSAT for testing and preparation for a Delta launch, pending agreement by Project Australis. Harry Helfrich and Jan King were given the responsibility of planning tests of the satellite at the NASA Goddard Space Flight Center.

April 10, 1969

The fifth general AMSAT meeting was held at Comsat. At this meeting the drafted bylaws, which had been distributed prior to the meeting, were discussed and it was concluded that further revisions would be required. The AMSAT Logo (emblem) was approved.

April 13, 1969

A Board of Directors meeting was called to discuss the conditions under which Project OSCAR was turning over the Australis-OSCAR A satellite to AMSAT.

April 14, 1969

The Australis-OSCAR A satellite was hand-carried to Aeronautical Radio, Inc. at Annapolis, Md., from the West Coast and delivered to Cap Petry.

April 24, 1969

An AMSAT meeting was held at NASA-GSFC. The Austrialis-OSCAR A satellite was brought to Goddard, opened, and inspected. Dave Collins, K2LME, showed slides of the East Coast VHF Society's station set up for OSCAR's III and IV. The meeting concluded with a tour of the Goddard satellite testing facilities.

April 26, 1969

Cap Petry addressed the Dayton Hamvention on the subject of AMSAT.

April 26, 1969

A Board of Directors Meeting was held at Perry Klein's apartment to finalize the bylaws. The task was not completed and another meeting was called for April 29.

April 29, 1969

Another Board of Directors meeting was held at Jim Puglise's home to complete the bylaws. The bylaws were put

into final form for approval by the AMSAT membership.

May 8, 1969

A general AMSAT meeting was held at Comsat to approve the bylaws. After some discussion and several changes, the bylaws were officially approved by the membership. A technical progress report on Austrialis-OSCAR A was given by the AMSAT members involved in the test program. It was announced that Jan King, K8VTR, had been designated AMSAT's Austrialis-OSCAR A Project Manager, with responsibility for all activity and decisions involving the satellite hardware.

May 27, 1969

Bill Orr, W6SAI, President of Project OSCAR addressed the AMSAT members at a general meeting held at the NASA Goddard Space Flight Center. Jan King presented a progress report on the Austrialis-OSCAR A satellite test program, and the members were shown the test facility and the subsystems. Bill

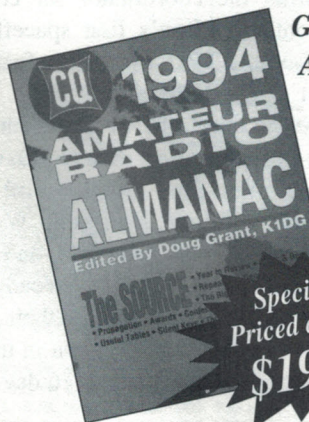
Dunkerley, WA2INB, AMSAT's ARRL Coordinator, was sent down from ARRL Headquarters and said a few words on behalf of League Headquarters. A committee was appointed to recommend to ARRL a U.S. Amateur position for the 1971 Space World Administrative Radio Conference, and Don Jansky of the Office of Telecommunications Management was designated chairman.

June 19, 1969

A meeting of the Board of Directors was held at Comsat to discuss the AMSAT newsletter, elect a new secretary to replace Jim Puglise who plans to leave the Washington area, and augment the interim Board to its full strength of seven members. Sajjad Durrani was designated Newsletter Editor and funds were appropriated for the first issue. Charles Dornian, W3JPT, was elected as Secretary, and he and William Tynan, W3KMY, were elected as additional members of the interim Board.

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STS-64, currently planned for September 9th, will be the 13th SAREX mission. The commander, Dick Richards KB5SIW, earned his license two years ago while training for the STS-50 SAREX mission. Pilot Blaine Hammond KC5HBS and mission specialist Jerry Linenger KC5HBR recently earned their own licenses. The other crewmembers are mission specialists Susan Helms, Mark Lee, and Carl Meade.

The mission is planned as a 9 day single-shift mission on Discovery. The launch window on September 9 is 4:30 to 7 pm EDT. The shuttle's altitude will be 140 NM. (259 km.) and its inclination will be 57.1 degrees.

The other payloads for the mission will be the first flight of LITE, the LIDAR In-space Technology Experiment, Spartan 202-01 free flyer and GAS Bridge. LITE will zap a laser beam in ultraviolet, visible, and near infrared wavelengths and look for its return. This will result in the shuttle's payload bay facing the Earth for much of the mission, with good antenna angles. The problem is with a six person crew and several power-intensive payloads the mission's power budget is extremely tight. The shuttle generates power on orbit with fuel cells using liquid hydrogen and liquid oxygen. Discovery has four sets of dewars located under the shuttle's cargo bay. There is always additional propellant carried as a safety margin, and the electrical margins allotted to the shuttle and each payload is calculated conservatively. In many cases missions have been extended because the astronauts and payload didn't use as much power as originally anticipated.

Another important factor is the number of launch delays. The fuel cells dewars are filled several days before launch. As the shuttle sits on the pad the propellants evaporate. If there is a one or two day launch delay there isn't enough time to top off the dewars with additional hy-

drogen and oxygen. So shuttle propellant budgets are based on the assumption that there may be a one or two day launch delay. If a launch delays beyond two days then the dewars are refilled.

So what does this all have to do with SAREX? One of the reasons SAREX gets to fly so often is its flexibility. If there is plenty of room and crew resources available then the all-up configuration can be flown with fast scan television, slow scan, and packet capabilities. On the other hand, if a mission is restricted by the amount of power which can be produced the transceiver and antenna can be flown in the -B version with voice only capabilities. With the -B version, last flown on the STS-45 mission, enough batteries are carried for all of the preplanned contacts and several passes for random QSOs. Another advantage to the -B configuration is it doesn't require any orbiter resources. The disadvantage is the lack of packet capability.

On STS-64 SAREX is officially manifested in the -B configuration, but the entire -C version hardware will be flown. If the shuttle's power budget after it's in orbit has enough of a power surplus the astronauts may get permission to set up the -C configuration. If the shuttle is power-limited then the hardware will be used in voice-only mode. So be prepared to make packet contacts with Discovery - just in case it's available.

The rest of the mission will be filled with new activities. LITE is a brand new payload. It was developed as a technology tool but is being used for atmospheric physics. Its green pulse will be bright enough to be visible from the ground as a brilliant flash of light - if you're lucky enough to be in exactly the right place at the right time.

The crew will deploy the Spartan free-flying satellite. The Spartan is similar to the Spartan which flew on the STS-56 mission. After the Spartan payload is de-

ployed the shuttle will back off to about 40 miles (70 km.) away and a couple of days later will perform a rendezvous to capture the spacecraft and put it back into the cargo bay. Since the shuttle is altering its orbit by a relatively small amount you will not have to update your Keplerains too often unless you are using a tight beam antenna.

One of the most exciting aspects will be a generic EVA (Extravehicular Activity - NASAese for spacewalk). Astronauts Mark Lee and Carl Meade will get to try out a new compressed gas jet backpack, the SAFER (Simplified Aid for EVA Rescue).

The next flight after STS-64 that will fly SAREX equipment is STS-67, the ASTRO-2 mission. STS-67 is scheduled for January 1995 and will feature the return to space of Ron Parise WA4SIR, one of the most popular ham astronauts. Ron was a ham and AMSAT member well before his selection as a payload specialist. He's extremely active in the SAREX program, often the coordinator for educational contacts. Ron's first spaceflight, the STS-35 ASTRO-1 mission featured the first packet operations on a U.S. spacecraft. Other STS-67 crewmembers include commander Steve Oswald KB5YSR, pilot Fred Gregory, mission specialists Tammy Jernigan, Wendy Lawrence, and John Grunsfield, and payload specialist Sam Durrance. Wendy and Sam are planning on getting their ham licenses. SAREX will be flown in the -C configuration on this planned 16 day mission.





On the morning of April 11, 1994 a group of Hazel Park Amateur Radio Club members was busy making the final preparations at the Ealy Elementary School of West Bloomfield, Michigan for a scheduled contact with STS-59. The youngest member of the club Christine Ode, age 11, was to be the control operator. At 2:15 she began calling "N5QWL this is W8JXU..." After several calls everyone was rewarded with "W8JXU this is N5QWL". The contact was made! Several students in the group asked questions. The total length of the contact was just under six minutes. It was long enough to get the students, parents and teachers of Ealy school very excited.

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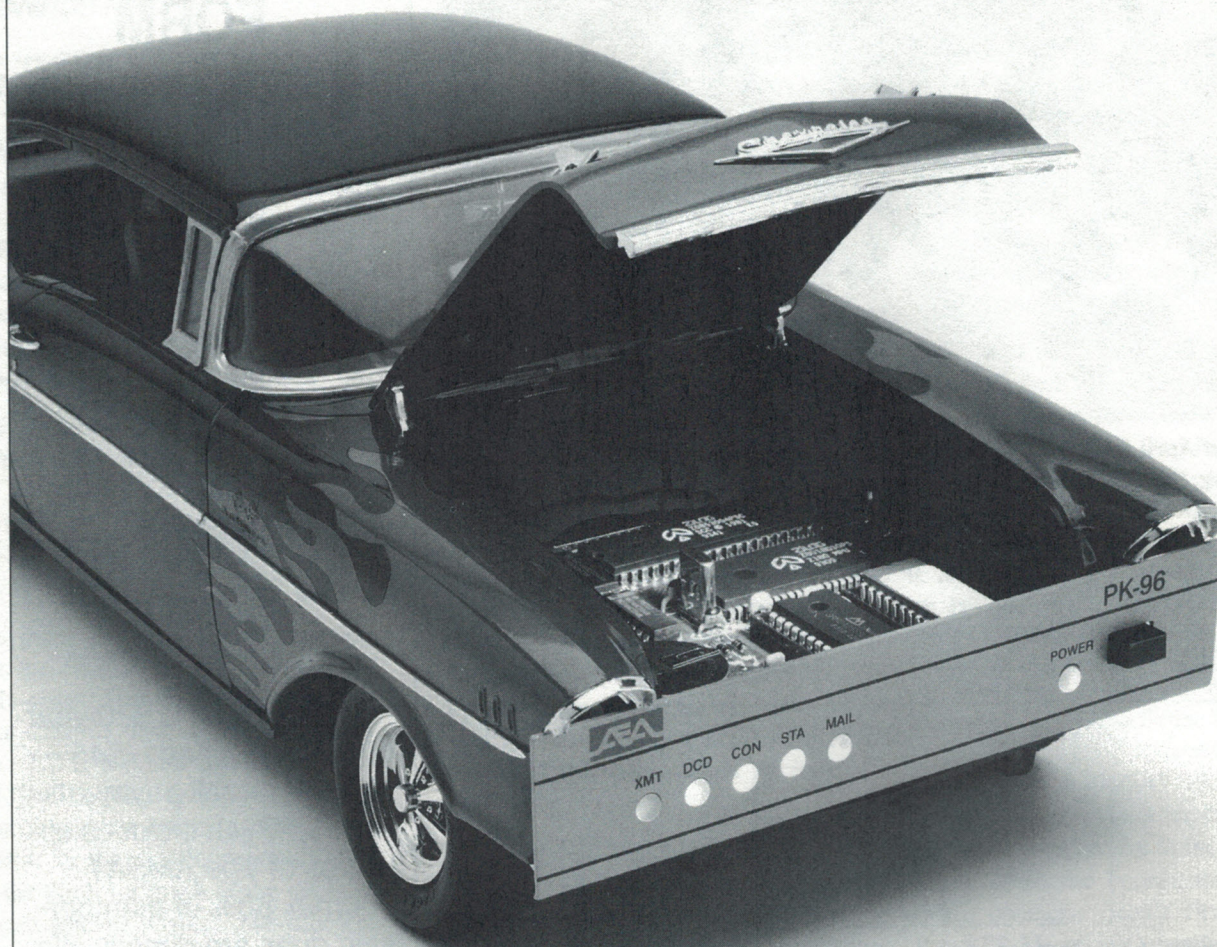
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